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MONITORING AGRICULTURAL PESTICIDE RESIDUES

A Preliminary Report of Studies on Soil, Sediment, and Water in Mississippi River Delta

Agricultural Research Service
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CONTENTS

MONITORING AGRICULTURAL PESTICIDE RESIDUES

A Prelimary Report of Studies on Soil, Sediment, and Water in Mississippi River Delta, 1964

Plant Pest Control Division
Agricultural Research Service
U.S. Department of Agriculture

INTRODUCTION

To carry out its responsibility in monitoring the impact of the normal use of agricultural pesticides, the U.S. Department of Agriculture established a pilot study in the Mississippi River Delta in May 1964. The objective of the first year's operation was to determine existing pesticide residue levels in soil, sediment, water, crops, livestock, and certain species of aquatic and terrestrial animal life. Special attention also was given to pesticide impact on nontarget insects, including bees and other beneficial species. The program in the Delta is to continue over a minimum period of 3 years to determine the rates of accumulation or depletion of residues in the various components of the environment.

The program was established through close cooperation of Agricultural Research Service Divisions interested in pesticide use. The agencies most active in the design and establishment of the program included Plant Pest Control, Entomology Research, Pesticides Regulation, and Animal Health. Biometrical Services assisted in planning the study and analysis of results. The Plant Pest Control Division was assigned the primary responsibility for conduct of the operations.

To implement the program, five locations, involving cotton, rice, and soybeans as major crops, were selected for study in the Mississippi River Delta drainage area--two in Arkansas and three in Mississippi. Each location contained two 1 square-mile areas. The areas were subdivided into blocks according to crops for sampling purposes. Samples of environmental media were collected on a scheduled basis and submitted to the laboratory at Gulfport, Miss., for residue analysis. Collections were supported by current pesticide use records, including materials used, amounts, and methods of application. In addition, through cooperation of owners and operators, a pesticide use history was compiled for each area by year for the past several seasons.

This report covers investigations on residue levels in soil, sediment, and water during the first season's studies. A total of 3,246 samples were collected in 1964 for analysis; 2,186 of these involved soil, sediment, and water. Confirmatory work is still being conducted on the remaining 1,060 samples. Approximately one-half of these samples are apiary; the remainder are crops, wildlife, aquatics, soil organisms, and miscellaneous.

It should clearly be understood that this is a preliminary report and the results shown are indicative only. The analytical results are not corrected for recovery. If corrected, the values presented will be substantially higher. Future analytical reports will be corrected for recovery. A more definite picture of the fate of pesticides in the study areas will evolve as the program progresses through further investigations of residue levels in the different components of the environment.

Each 1 square-mile area is regarded in this report as an entity. An attempt was made at the outset of the program to obtain two areas at each location with contrast in pesticide use. This was not possible in most cases, however, due to consistency in farming practices. Statistical examination of preliminary results confirmed the lack of significant variability between the two study areas at any one location; therefore, the data are summarized for each of the 10 areas in the 1964 study.

Arsenic analyses were made in the Entomology Research Division, Kerrville, Tex., laboratory. Most of the phosphate analyses were conducted in the Tifton, Ga., laboratory of that Division.

FIELD SAMPLING PROCEDURES

The first sampling was initiated in May 1964, and completed in June. An additional set of samples was collected each month thereafter through October. A postseason sampling was conducted during January 1965. In addition to the scheduled sampling of selected water sources, supplemental water samples were collected when possible, e.g., quick runoff after rains.

A. Soils

Two samples were taken per block at each sampling. A block was defined as a portion of the 640 acres and is designated as such from actual farm use. Block size, depending upon cropping practices in an area, varied considerably. One sample was taken along a line diagonally across the block, the other sample along the other diagonal of the block at an angle to the path taken by applicators during pesticide treatment. A soil corer, 2 inches in diameter, was used to collect the samples. The separate cores were spaced equidistant along the diagonals without actual measurement. Each sample consisted of 25 cores taken to a depth of 3 inches each. The composited cores were passed twice through a 1/4-inch screen to insure thorough mixing. Stones, roots, twigs, grass, etc., were discarded. A new 1-gallon container was then filled with the mixed, screened soil. The container was properly sealed, labeled, and shipped to the laboratory.

Special profile studies to measure vertical movement of pesticides in soils was initiated in 1965. Soil to a depth of 3 feet will be analyzed in pilot studies.

B. Water (Ponds, streams, other surface sources):

Two samples were taken in each scheduled sampling period. The area to be sampled was divided into halves and a sample taken from near the mid-point of each half. A boat was used as required; otherwise, the sample was taken from the bank or by wading. In each case, a representative sample was collected. The samples were collected as follows:

1. Subsurface water

   A hand pump with a hose connection was used to draw subsurface water from a pond or stream directly into the sample bottle, a 5-gallon carboy. This was a two-man operation--one man held the suction hose of the hand pump and gradually moved it back and forth with the intake a few inches below the surface, the other man operated the pump and directed the outlet into the sample bottle.

   To obtain a bottom sample, the pump sample hose was fastened to a pole long enough to reach the bottom. The inlet of the hose was fastened 1 foot from the bottom of the pole. As one man operated the pump, the other slowly moved the pole along the bottom. A certain amount of silt was stirred up in this operation and found its way into the sample bottle. However, before extraction for analysis, the sample was decanted into a clean container.

2. Surface water

   A flat scoop was used to take surface-film water. The surface of the pond or stream was skimmed at representative points. Sampling was carried on until a 5-gallon composite sample was obtained.

3. Wells

One composite 5-gallon carboy sample was taken from wells in each area at each sampling period. Where more than five wells existed in the area, sampling was limited to that number.

C. Sediment

Sediment samples were collected by using a soil corer, 2 inches in diameter, with a long handle. The soil corer, 18 inches in length, was driven into the bottom far enough to just reach solid earth. The core was emptied into a collecting container. A sample consisted of twenty-five 2-inch diameter cores of silt collected at random over the water source. After all the cores were taken and the water decanted, a stick or dowel was used to completely mix the sediment in the sampling container; then, a portion of the mixture was transferred to a clean 1-gallon sample pail. The pail was tightly closed, properly labeled, and submitted to the laboratory for analysis.

Pertinent background information was provided for each sample on accompanying data sheets for use in analysis and evaluation. In completing the forms, particular attention was given to unusual pesticide contamination factors, such as spillage in loading of spray equipment, abnormally heavy drift, or unusually heavy rains.

It should be pointed out that sampling design and procedures were reviewed against analytical results following the 1964 season. Modifications were made, where indicated, in an attempt to collect samples of a more representative nature.

METHODS OF CHEMICAL ANALYSIS

Procedures used in chemical analysis given in this report are presented in condensed form below. A manual of "Methods Used in Analysis of Pesticides for Agricultural Monitoring" was developed by the laboratory staff. It is well to emphasize here that pesticide residue analysis is dynamic and constantly changing, as new methods and techniques are developed. The latest and best equipment available is being used in this study.

The greatest effort is being devoted to the development of techniques used to clean-up samples. Every effort is being made to improve this situation and, at the same time, permit better separation of the extraneous materials that often accompany such residues upon extraction.

Cooperative relationships are maintained with Federal, State, and industrial laboratories so improved techniques are put into use as they are developed.

The changing methods and techniques bring about the problem of interpreting old data in light of new. Many hundreds of the samples have been re-examined and if new data were obtained, they are included in this report.

The most persistent problems in this residue study centered around interferences. Several of these had to be resolved and samples re-examined before the data could be released.

The presence of an undetermined chlorinated hydrocarbon at significant levels in numerous soil and silt samples, suspected to be toxaphene and/or Strobane, indicated need for study of the determination of these two insecticides by the analytical staff. A technique was developed utilizing thin-layer chromatography for separation and colorimetric methods for quantification. Residue levels of toxaphene and/or Strobane should be considered as preliminary determinations, however, in this preliminary report.

To meet goals established at the beginning of the program, certain arbitrary limits of definition had to be set. For soils and silt samples, any chlorinated hydrocarbon residue that was less than 0.1 p.p.m. (parts per million) but more than 0.05 p.p.m. was recorded as 0.08 p.p.m. Residues less than 0.05 p.p.m. were not reported. For water, these limits were recorded at 0.08 p.p.b. (parts per billion) if less than 0.1 p.p.b., and less than 0.05 p.p.b. was not reported. The reasons for this are based on the difficulty in identifying positively any residue below these limits. Adjustments will be made if future program needs determine these limits should be changed.

In determining overall averages of pesticide residues in this report, zero values were placed on all analyses determined and reported at ND (no residue detected).

A. Equipment

The following equipment was used in this study:

1. F & M Model 810 gas chromatograph equipped with flame, thermocouple, and electron capture detectors.
2. Two Jarrell-Ash Model 28730 gas chromatographs equipped with electron capture detectors.
3. Three Spectronic 20 colorimeters.
4. Two complete thin-layer kits by Brinkmann.
5. Perkin-Elmer Model 221 infrared spectrophotomer with KBr pellet press and microcells.

B. Analysis of soil

Soil for analysis was screened to remove roots and stones and to insure uniformity of the sample. Moisture was determined on a 100-g. subsample. This was heated in an oven at 125° C. until there was no further weight loss. The percentage of moisture was then determined.

Then 300 g. of the soil, based on dry weight, was placed into a one-half gallon mason extraction jar and 600 ml. of 3:1 hexane-isopropanol solvent added. A new cap was placed on the jar and the jar sealed. The sample identification number was placed on the extraction jar and on every other container into which the sample, or portions of the sample, were placed.

The extraction jar was rotated concentrically at 30 r.p.m. for 4 hours. After allowing to stand to permit settling, approximately 200 ml. of extract solution was filtered into a 500 ml. separatory funnel. The solution was washed twice with distilled water. The water washings and any "cuff" remaining at the interface were discarded. The remainder of the washed solution was drawn off into the laboratory sample jar. At this point, each ml. of solvent contains extract from 0.67 g. of soil.

For preliminary survey, 5 microliters of solution were injected into gas chromatograph equipped with a 4-foot glass column containing 5 percent SE 30 on Chromosorb W. Temperature of column was maintained at 185° C., the injector port at 220° and the electron capture detector at 200°. Amplification of the instrument was set to provide half-scale deflection of the recorder with 0.5 nanograms of aldrin. No further determinations were made on blank samples beyond the preliminary survey.

In many instances, no further confirmation was required if a few well defined peaks were present, the retention time fitted the standards exactly, and there was a history of use of the particular pesticide involved. Such would be the case with BHC (benzene hexachloride), DDT, and heptachlor.

Clean-up and separation of certain pesticides were accomplished according to the Food and Drug Administration technique, using a Florisil column, or by a thin-layer technique. After separation by either method, the eluates were concentrated to known volumes and injected into the gas chromatograph as previously described. The peaks were then identified.

C. Analysis of Water

Water is delivered to the sample processing laboratory in 5-gal. bottles. Each sample bottle was weighed and water decanted into a 5-gal. extraction bottle, using care not to unduly disturb the sediment in the sample bottle. Then the sample bottle was reweighed. Calculation then gave the weight of the water to be extracted. Then, 1,000 ml. of 3:1 redistilled pentane-ether solution was added to the extraction bottle. After closure, the extraction bottle was rotated 20 min. at 30 r.p.m. The hydrocarbon solution was then decanted to a sample flask by syphon arrangement. The solution was concentrated to 10 ml. and a 5-microliter injection made into the gas chromatograph to determine the presence or absence of insecticide, as in the soil analysis.

If insecticides were present, the sample was returned to the laboratory for separation, though thin-layer, of the aldrin, dieldrin, and endrin group of insecticides from the DDT family.

After separation and extraction from the absorbant, the separation concentrates were diluted to known volume and re-examined on the gas chromatograph.

D. Analysis of Sediment

Silt, sludge, sediment, and the like, which represent soil carried and deposited by water, were analyzed in much the same manner as the soil except for the extraction step. Anhydrous sodium sulfate is added after the addition of the hexane-isopropanol solution.

EXPLANATION OF TABLES

The information presented in the tables accompanying each study area was obtained through detailed studies of pesticide use patterns on each of the areas and subsequent residue analysis of samples collected from late May and June 1964 to February 1965.

1. The cumulative amounts of pesticide applied were obtained in pounds per acre from treatment records on each field or block. Not all of the fields or blocks were treated in any 1 year; however, owing to crop rotation or other factors all fields may have received one or more treatments over the period indicated. Cumulative totals per acre are based, therefore, on the total treated cropland acreage. This gives a basis for comparing average amounts of residues found in treated cropland with cumulative input of pesticides. In this study, 1 part per million equals approximately 1 pound per 3-inch acre.
2. The average amount of residue per sample is given in parts per million for soil and sediment and parts per billion for water. The overall averages were obtained by totaling the detectable amount of residues in each sample and dividing by the total number of samples analyzed. For the purposes of this report, all individual residue analysis reported as ND (no residue detected) were given the value of zero, even though it was possible that a majority of these samples contained levels up to 0.05 p.p.m. in soil and sediment, and 0.05 p.p.b. in water. Average residue levels of less than 0.01 p.p.m. in soil and sediment are preceded by the symbol < (less than).
3. The analyses of Stobane/toxaphene, methyl parathion, and sulfur were completed on only part of the 1964 samples. Averages are for positive samples only on these materials with the number of samples from which the averages were obtained being included with the figure.
4. The analyses of BHC/lindane is based on the determination of the gamma isomer of benzene hexachloride used for cotton insect control in past years, particularly in the 1940's and early 1950's. Lindane is the approved common name for the purified gamma isomer of BHC.

PROFILES OF STUDY AREAS, 1964

Area CHA

A. General Description

Area CHA is located in the vicinity of Crystal Springs, Miss. This area of the State once produced large acreage of truck crops. In recent years, however, vegetable production in this area has been reduced greatly. The farm on which CHA is located is one of the most productive in the area. Cotton is the principal crop. Soybeans, cabbage, and corn also were grown in 1964. The fields are interspersed with pastures. Woodland or wildlife area is found on about 100 acres. There are two permanent ponds. A creek borders one side of the area. (Figure 1.) Methyl parathion and DDT have been used for cotton insect control since 1955. Strobane and/or toxaphene also have been applied each year since 1960.

Weather data for study area CHA are given in table 1 at end of report.

B. Description of Soil

Soils of the uplands have grayish-brown silt loam surface layers and yellowish-brown heavy silt loam or silty clay loam upper subsoils. Most of these have a very dense mottled layer

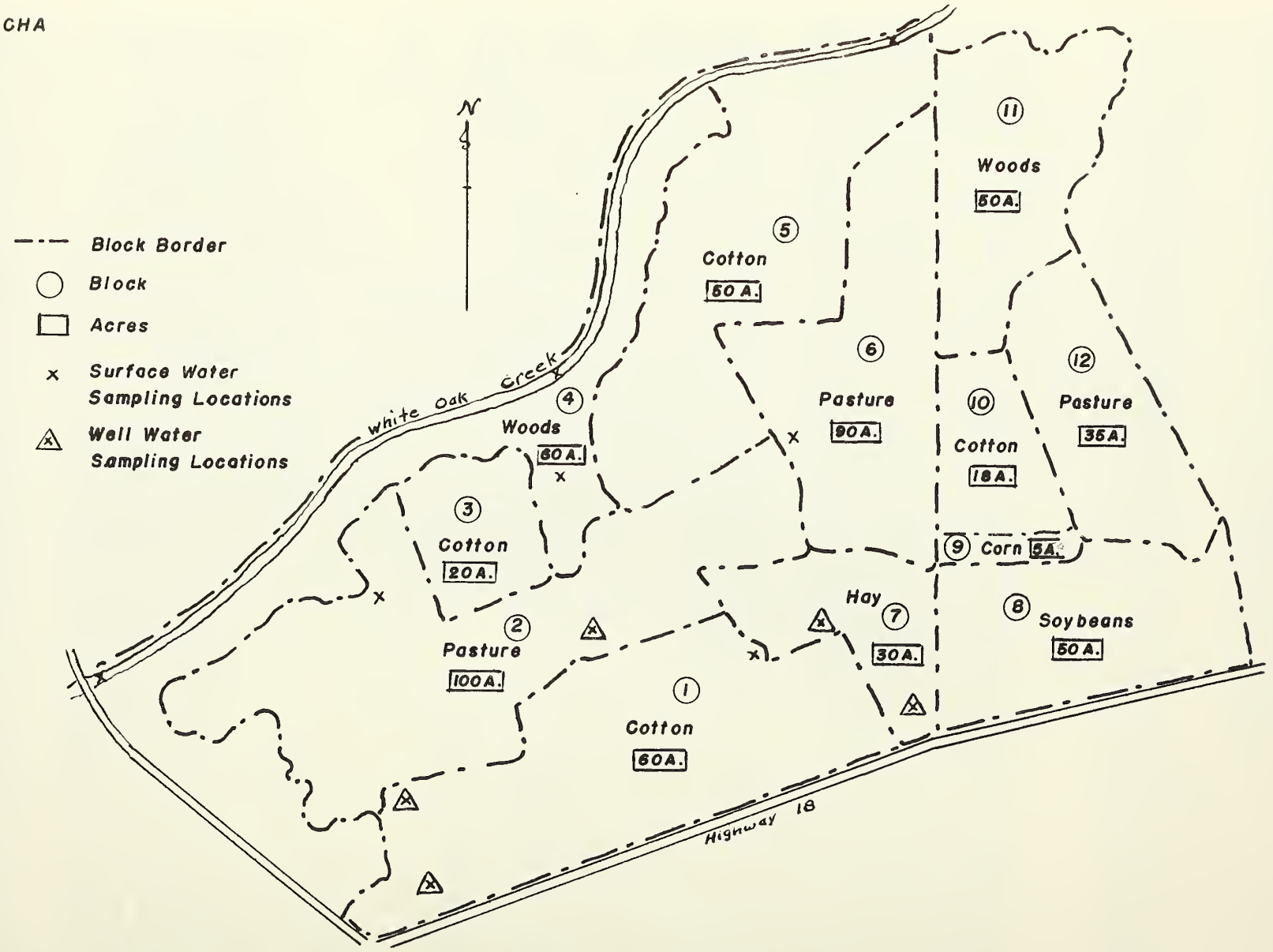
Block Border
Block
Acres
Surface Water Sampling Locations
Well Water Sampling Locations
N
White Oak Creek
Highway 18
1 Cotton 60A.
2 Pasture 100A.
3 Cotton 20A.
4 Woods 60A.
5 Cotton 60A.
6 Pasture 90A.
7 Hay 30A.
8 Soybeans 50A.
9 Corn 5A.
10 Cotton 18A.
11 Woods 50A.
12 Pasture 35A.

Figure 1

(fragipan) at depths ranging from $1\frac{1}{2}$ to $2\frac{1}{2}$ feet. This layer is very slowly permeable to water; most plant roots do not penetrate it. These soils are low to medium in plant nutrients and are acid in reaction throughout unless limed.

Soils of the bottom lands are grayish brown or yellowish brown in color and are mostly silt loam throughout. Most of them are subject to annual flooding, and most of them have gray mottle in the layers below the plow layer. These soils are also low to medium in plant nutrients and are acid in reaction throughout unless limed.

C. Analytical Results

Residues of arsenic were significantly lower on uncultivated than on cultivated land. Higher residues on crop land can be attributed possibly to treatments of calcium arsenate on cotton in past years, and possibly to Paris green on truck crops when this area was in truck crop production. Arsenic residue levels are lower in this area than those determined in some of the other study areas. BHC/lindane and dieldrin residues were found at "low" levels in the soil; 0.02 p.p.m. and <0.01 p.p.m., respectively, in cropland. It can be noted from the tables that levels of dieldrin, 0.01 p.p.m., were higher in uncultivated land. The highest monthly average readings of these materials in sediment was 0.01 p.p.m. Dieldrin was not detectable in water; BHC averaged 0.05 p.p.b. in surface water. DDT, one of the principal insecticides used in this area, was found at 1.46 p.p.m. in cultivated land; 0.36 p.p.m. in uncultivated land. The increase from the June 1964 sampling period to the January 1965 sampling period almost duplicated the cumulative amounts applied to cotton during the current control season. Persistence of this level in soil through the winter will be determined through analysis of 1965 samples. Residue levels of DDT in sediment reached highest levels, 4.5 p.p.m., in February; however, the season average was 0.5 p.p.m. DDT was detectable in water only in quick-runoff samples taken in January. Increased rainfall during October, November, and December may have influenced the increase in DDT residues in sediment. Endrin was at nondetectable levels in soils and water, although 0.1 p.p.m. was recorded in July and 0.04 p.p.m. in February sediment samples. The last treatment was applied in 1962. Strobane/toxaphene levels were the highest of any single chlorinated insecticide. However, too few samples were analyzed to make any conclusion. Tables 2 to 5 at end of report present detailed analytical results.

Area CHB

A. General Description

Area CHB is located near Utica, Miss. The farming practices of this study area contrast sharply to the highly mechanized operations and intensive culture found on the study areas in the Greenville area. Mule-drawn equipment still is used in cultivation. Only 145 acres of the 545 acres included in the area are in cultivation. (Figure 2.) In 1964, cotton was grown on 100 acres, corn on 45 acres. The pastures contain several ponds.

One pasture on CHB contains an airstrip used by spray planes. Soil samples from the pastures should furnish a comparison between residues in uncultivated areas and those on treated croplands. DDT and methyl parathion have been the principal insecticides used for cotton insect control in the past several years; toxaphene, however, has been used in at least 4 of the last 10 years.

Weather data for study area CHB are given in table 6 at end of report.

B. Description of Soil

The soil types in CHB are essentially the same as those found in CHA; however, the terrain is slightly sloping. The area is bordered on two sides by creeks.

C. Analytical Results

Arsenic levels were approximately the same in both cropland and uncultivated land. Only "low" levels of BHC/lindane used in the late 1950's were recovered in soil. Residue levels were

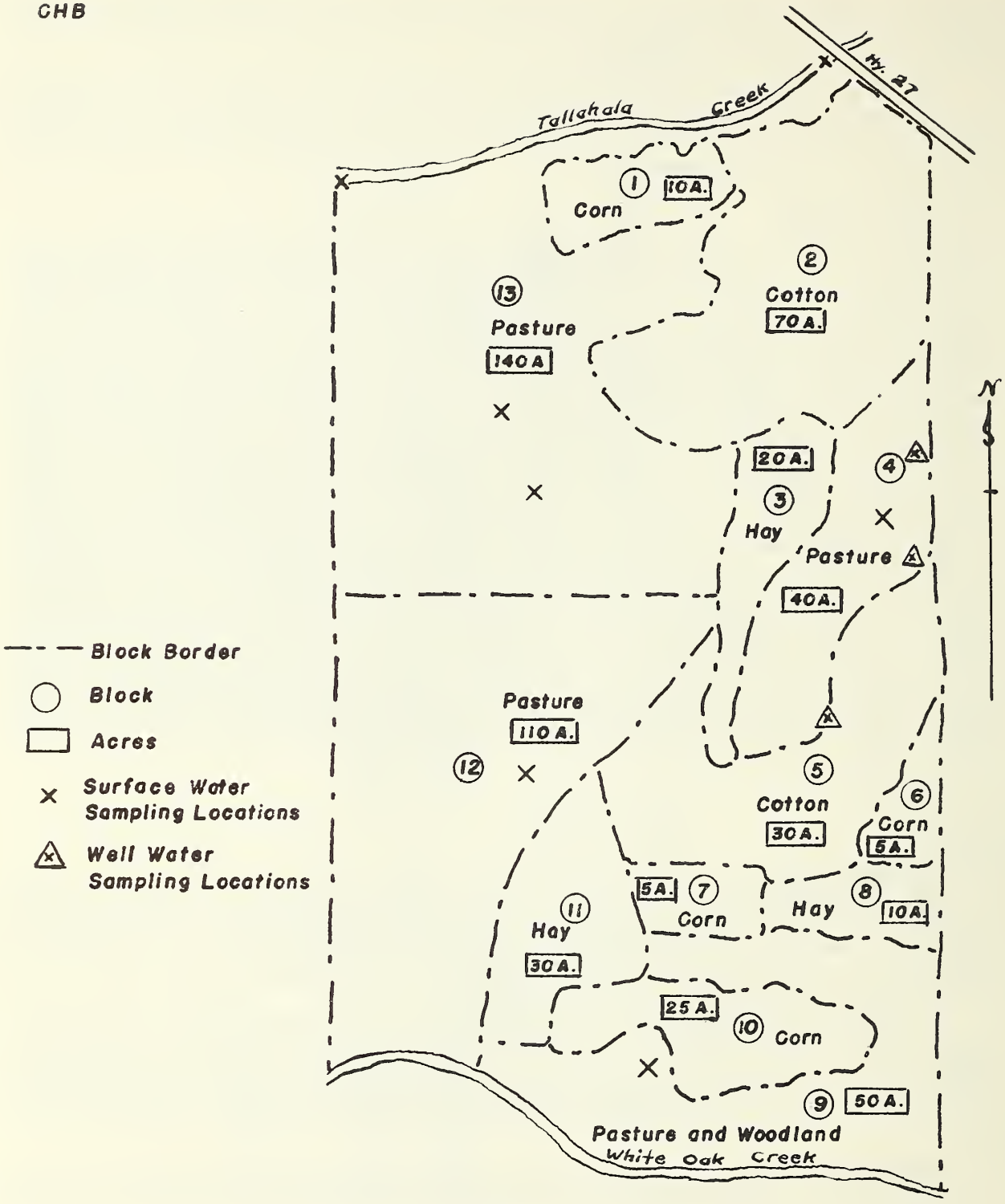
Tallahala Creek
Hy. 27
1
10A.
Corn
2
Cotton
70A.
13
Pasture
140A
20A.
4
3
Hay
Pasture
40A.
N
Block Border
Block
Acres
Surface Water Sampling Locations
Well Water Sampling Locations
Pasture
110A.
12
5
Cotton
30A.
6
Corn
5A.
5A.
7
Corn
8
Hay
10A.
11
Hay
30A.
25A.
10
Corn
9
50A.
Pasture and Woodland
White Oak Creek

Figure 2

nondetectable in water and sediment. Endrin levels generally were non detectable in soil and sediment, but a level of 1.87 p.p.b. was found in well water in December and January samples. Its presence in this medium is unexplainable. No application of this material has been reported on the area since 1958.

Dieldrin was detected at "low" levels in some soil and sediment samples. DDT is one of the principal insecticides used on this study area; however, residue levels in soil are below 1 p.p.m. except in blocks where the material was applied in 1964. As in CHA, the amount of residues found in some soil samples in treated blocks approached the cumulative amount applied during the season. A small amount was found in well water in December and January. Residues in sediment were at "low" levels from May through September and increased slightly during the winter months.

Tables 7 to 10 at end of report present detailed analytical results.

Area GRA

A. General Description

Area GRA is located west of Greenville, Miss., south of and adjoining the Mississippi River levee. Over one-half the farm was planted in cotton in 1964. Other crops were soybeans, small grains, and sorghum. One-hundred acres are in pasture. (Figure 3.) Two sloughs are within the study area, which afforded excellent locations for determining the rate of movement of pesticides from treated areas to water sources.

This farm has a long history of use of endrin and methyl parathion for the control of cotton insects. An average of about 13 applications of each insecticide per season have been made since 1956. A single application of carbaryl was applied for cabbage looper control on soybeans in 1964 and one application of endrin and methyl parathion was made on corn.

Survey of pesticide practices on adjoining farms reveal that use on GRA is typical of its community. No pesticides have been applied to the uncultivated area north of the farm. Approximately 1 mile south of the area, DDT, toxaphene, and methyl parathion were used in 1964.

Weather data for study area GRA are given in table 11 at end of report.

B. Description of Soil

The dominant soils on the higher lying, gentle, convex slopes have medium and moderately fine grayish-brown or dark grayish-brown surface layers of silty loam and yellowish-brown finer subsoils, which are commonly mottled with gray in the lower part. These soils have acid surface layers; subsoils are less acid. They are medium to high in plant nutrients and lime.

The dominant soils on the lower lying flats or concave slopes have medium and moderately fine grayish-brown surface layers and grayish-brown, gray or yellowish-brown mottled subsoils of similar texture. These soils are medium to high in plant nutrients and in lime. They require artificial drainage for production of many crops. Associated with them are dark-colored clay in narrow bands of concave slopes. Other soils of minor extent, but locally conspicuous, are light yellowish-brown sands on narrow slopes of natural levels.

C. Analytical Results

Arsenic residue levels in soil may be slightly higher in cultivated cropland than in uncultivated; however, about 10 times more samples were taken in cropland. This could contribute to the variations in residue levels. "Low" levels of dieldrin were found in soil, water, and sediment although the last treatments of this chemical were applied almost 10 years ago. Similarly, BHC/lindane was present at "low" levels in soil and water. This material had not been applied since 1959.

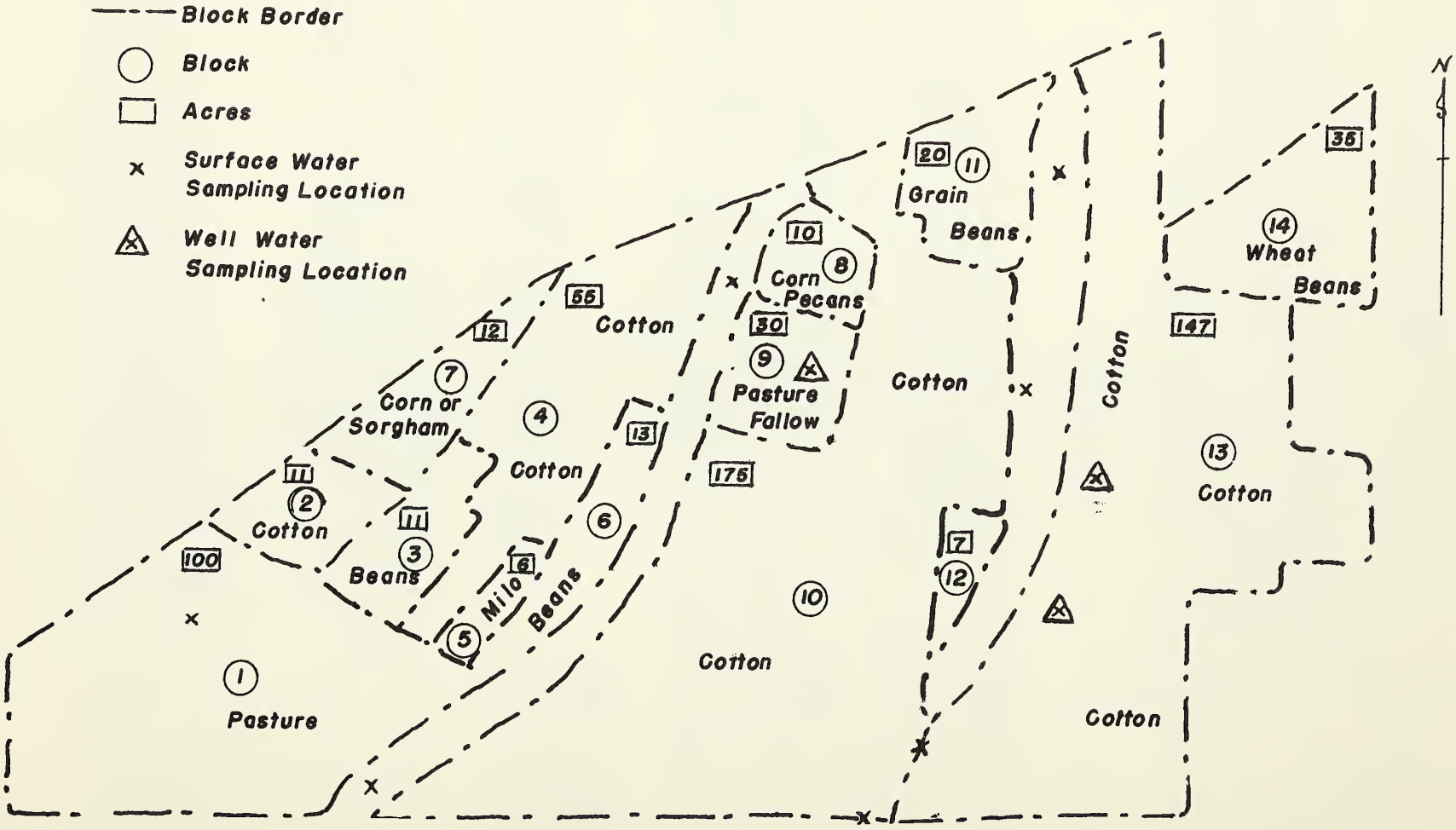
Block Border
Block
Acres
Surface Water Sampling Location
Well Water Sampling Location
N
1
Pasture
100
2
Cotton
11
3
Beans
111
4
Corn or Sorgham
7
5
Milo Beans
6
6
Cotton
13
7
Corn or Sorgham
12
8
Corn Pecans
10
9
Pasture Fallow
30
10
Cotton
175
11
Grain Beans
20
12
Cotton
7
13
Cotton
147
14
Wheat Beans
35
Cotton
55

Figure 3

Endrin has been applied on this area at an average of 12.9 applications per year for 9 consecutive years, yet only 0.05 p.p.m. was recorded for soil collected throughout the season even while new material was being applied. Surface water samples had low or ND (no residue detected) levels generally. However, quick runoff collected in January averaged 6.7 p.p.b. endrin. Sediment from surface water sources had an average of 0.1 p.p.m. for the season. DDT levels for all soil samples on cultivated areas averaged 1.2 p.p.m. compared with 0.07 p.p.m. on the pasture. Levels of DDT in sediment remained almost constant from May through September but increased significantly during November when the highest (2.49 p.p.m.) residue was recorded. Levels in water were detectable, however, only during January and February. Increased rainfall during the fall and winter months might have contributed to this increase.

Tables 12 to 15 at end of report present detailed analytical results.

Area GRB

A. General Description

Area GRB is located near Indianola, Miss. The area is comprised of 577 acres of cropland and 70 acres of pasture. In 1964, cotton was planted on 225 acres, soybeans on 221 acres, and sorghum and oats on 89 acres. An airstrip used for spray planes is included in the area. There are no ponds or other permanent water sources. A lagoon used for irrigation, however, is located on one side of the area. (Figure 4.)

DDT and methyl parathion have been used for control of cotton insects since 1959. During 1964, cotton received at least nine applications of each insecticide and soybeans received one application of methyl parathion.

Investigation of pesticide-use practices on lands surrounding the GRB study area in 1964 showed the following: Most of the area 1 mile east and north was in untreated pasture and grain. To the south and west for one-half of a mile, pesticide use was the same as that of the study area; however, between $\frac{1}{2}$ and 1 mile some toxaphene, Di-Syston (O, O-diethyl S- [2-(ethylthio)ethyl] phosphorodithioate), and endrin were used.

Weather data for study area GRB are given in table 16 at end of report.

B. Description of Soil

The soils on the broad flats or slightly concave slopes, which dominate this area, have nearly black clayey surface layers and clayey dark colored subsoils. These soils shrink and swell upon drying and wetting and have many cracks during extended dry periods. They are relatively high in plant nutrients and in lime. On slightly higher lying areas with gentle, convex slopes, the soils have gray clayey or silty plow layers. There are more clayey subsoils that are mottled gray, yellow, and brown. These soils are somewhat more acid in the upper part. They are medium to high in plant nutrients. Poor drainage is the principal restriction for all of these soils; and all of them require artificial drainage for satisfactory crop production.

C. Analytical Results

Residue levels of arsenic were significantly higher in cropland on this area indicating a past history of treatment with calcium arsenate. Application of DSMA (disodium methanearsonate), an arsenical herbicide, possibly contributed to the buildup. Dieldrin residues were detected at low levels in soil, sediment, and water. Similarly, endrin residues in soil, water, and sediment were at "low" levels except in water in January when 2.04 and 5.13 p.p.b. were recorded in surface and runoff samples, respectively. These materials were last applied in 1958. DDT is one of the principal insecticides used in control of cotton insects in this study area. Residue levels averaged 2.17 p.p.m. in treated, cultivated blocks, and 0.28 p.p.m. in untreated, cultivated blocks.

GRB


Block Border
Block
Acres
Surface Water Sampling Locations
Well Water Sampling Locations
N
79
50
70
39
92
131
92
50
44
Hy 82
9
Beans
7
Sorgham
8
Oats / Milo
6
Pasture
4
Cotton
1
Cotton
3
Beans
5
Beans
2
Cotton

Figure 4

It is of interest that levels of 0.2 p.p.b. were found in well water in July and September and generally below 1 p.p.b. in surface water sources. Residue levels in sediment fluctuated throughout the season, running from 0.13 p.p.m. in June to 2.91 p.p.m. in February. Residue levels of Strobane/toxaphene were the highest of the chlorinated insecticides even though no treatments using these chemicals had been applied since 1960. On a pound per acre basis, the amount of these materials recovered exceeded the amount reportedly applied.

Tables 17 to 20 at end of report present detailed analytical results.

Area SCA

A. General Description

Area SCA is located about 20 miles north of Greenville, Miss. It contains 550 acres of cropland and 66 acres of pasture. Cotton was planted on 397 acres and soybeans on 128 acres in 1964. The area has no permanent water sources, such as ponds or streams; however, drainage ditch water is available for sampling. (Figure 5.)

A wide variety of pesticides have been used in cotton production on this farm. Endrin and methyl parathion have been used for cotton insect control since 1962; eight applications of these materials were applied in 1964. Dalapon was the only pesticide used in soybean production during the year. Pesticides used in 1964 on farms surrounding SCA included endrin, methyl parathion, toxaphene, DDT, and malathion.

Weather data for study area SCA are given in table 21 at end of report.

B. Description of Soil

The dominant soils have dark grayish-brown silt loam surface layers 6 to 10 inches thick and brown silty clay loam subsoils mottled with gray and yellowish brown. Grayish-brown silt loam substratum begins at depths of about $2\frac{1}{2}$ feet and extends downward for a few to several feet to material of contrasting texture. These soils are moderately acid throughout and are medium in plant nutrients. Restricted internal drainage is their principal unfavorable feature.

Soils of minor extent are dark-colored clays in narrow strips in sloughs and depressions and light-colored, well-drained sandy soils in narrow strips on natural levees.

C. Analytical Results

Arsenic levels are high on cropland in this area in comparison with other study areas. Recent applications of DSMA apparently contributed little, if any, to arsenic residue levels in croplands. Judging from levels found in the pasture in contrast to those in cropland, natural arsenic levels may be about 5 p.p.m. in this area. Although residues of BHC/lindane, dieldrin, and aldrin were found at "low" levels in soil and sediment, there were no records of these materials being applied to the area. An occasional sample indicated the presence of BHC/lindane and dieldrin in water. DDT levels in treated cropland soils and sediment averaged between 1 and 2 p.p.m. Levels in surface water sources were generally below 0.4 p.p.b. The last applications of DDT made on the area were in 1962. Endrin residues were only slightly higher, if any, in treated cropland than untreated cropland. Almost 13 pounds (cumulative) of this material had been applied over a period of 7 years on 506 acres of cropland. Only 0.09 p.p.m., however, was found in the soil. Residue levels in sediment increased slightly in November and December over levels during July, August, and September. No residues were detected in January and February sediment samples, but water samples showed considerable residue present in January. The occurrence of endrin in water at 13 to 14 p.p.b. during January and not at detectable levels in soil or sediment is unexplainable.

Tables 22 to 25 at end of report present detailed analytical results.

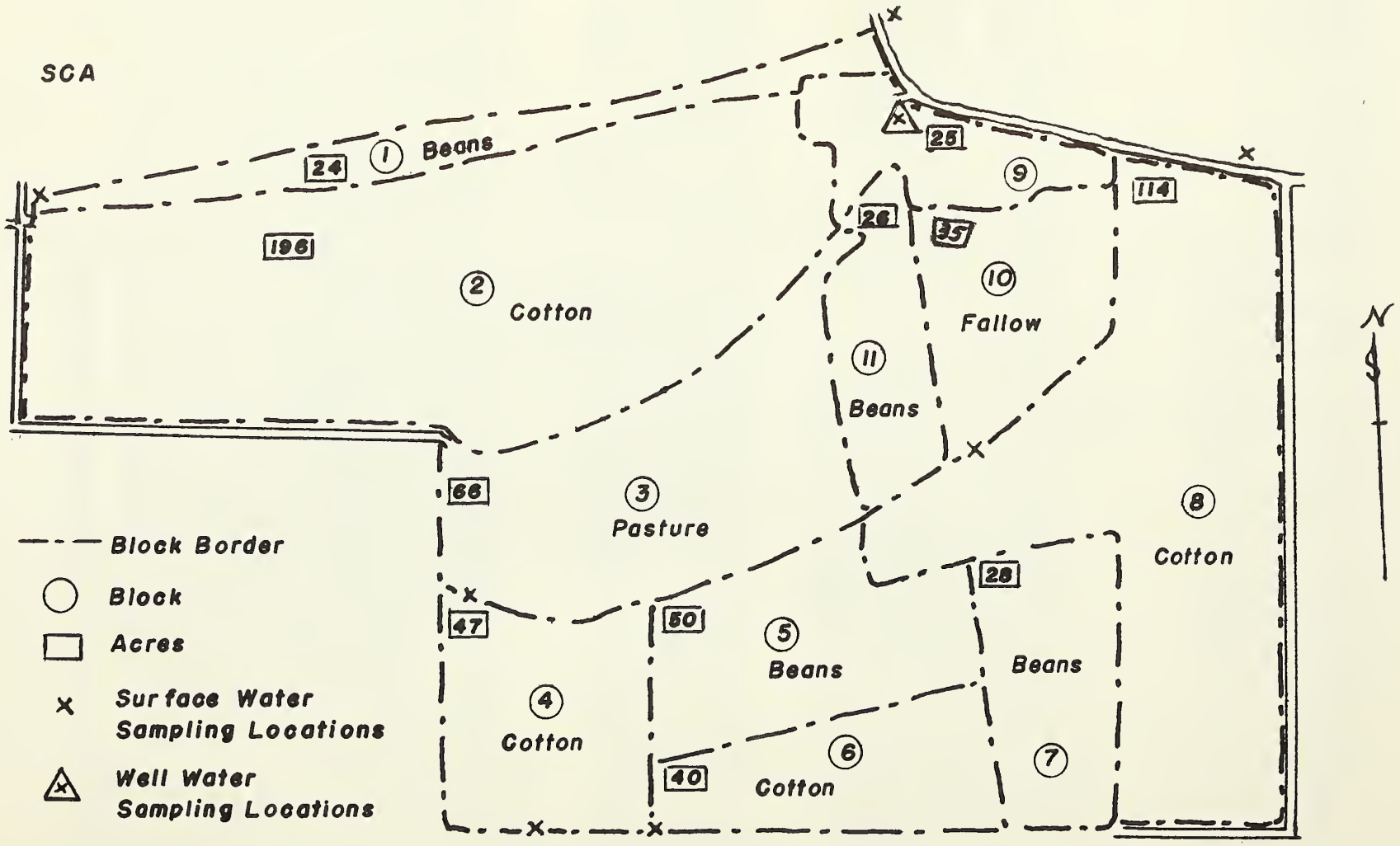
SCA
24
1
Beans
196
2
Cotton
25
9
114
26
35
10
Fallow
11
Beans
66
3
Pasture
8
Cotton
28
47
50
5
Beans
Beans
4
Cotton
6
7
40
Cotton
Block Border
Block
Acres
Surface Water Sampling Locations
Well Water Sampling Locations
N

Figure 5

Area SCB

A. General Description

Area SCB is located north of Greenville near the Mississippi River, in the vicinity of Area SCA. Of 577 acres in cultivation in 1964, 549 acres were planted to cotton. (Figure 6.) As for the past several years, endrin and methyl parathion were the principal insecticides used for cotton insect control during the year. Nine applications of these materials or more were applied from mid-June to mid-September. SCB also contains a 67-acre pasture and a small wildlife area.

SCB is bordered on the southwest and the northwest by a levee. Pesticide use on the levee and behind the levee is negligible. All land for 1 mile east of SCB is under the same management as the study area. Pesticide treatments on cotton are identical to those given cotton on the study area. No pesticide was used on soybeans or pasture in SCB in 1964.

Weather data for study area SCB are given in table 26 at end of report.

B. Description of Soil

The dominant soils are on level to very gentle slopes and have grayish-brown very fine sandy loam surface layers, which at about 12 inches grade into gray, grayish-brown, and yellow mottled subsoils of similar texture. This layer continues to a depth of 3 to many feet. These soils are near neutral in reaction and are medium to high in plant nutrients. Restricted drainage is their principal unfavorable feature.

Minor soils are dark-colored clayey soils in narrow sloughs and depressions and light-colored well drained sandy soils in narrow strips on the slopes of natural levees.

C. Analytical Results

Arsenic residue levels approached 12.90 p.p.m. in treated cropland in this area while levels were about 5.90 p.p.m. in uncultivated land. As with SCA, treatments with calcium arsenate in prior years are reflected in these residue levels on cropland. Low residues of aldrin and dieldrin were detected in soil, water, and sediment with the exception of the December 1964 samples of sediment which averaged 2.34 p.p.m. aldrin. No BHC/lindane residues were found in soil and sediment and "low" amounts were detected in water. DDT residues in treated cropland were about twice those determined for uncultivated land. Levels in soil appeared to be rather persistent since no treatments were applied since 1962. Residue levels in sediment increased during the winter. This probably can be attributed to the increased rainfall during the latter part of the year. Residue levels in water were rather inconsistent. Endrin has been one of the major insecticides used in the control of the cotton insects in this area since 1957; thus, it is of interest that the average level found in soil in 1964 was only 0.34 p.p.m. Residue levels in sediment increased substantially during December and tapered off during January and February. Water samples contain the greatest amount of residues in January, when an average level of 17.46 p.p.b. was found in surface water.

Tables 27 to 30 at end of report present detailed analytical results.

Area STA

A. General Description

Study areas were established in the Stuttgart, Ark., area primarily to determine the effects on the environment of aldrin used as a seed treatment in rice production.

Rice in this location is grown in rotation with soybeans. A total of 164 acres of rice was planted on area STA in 1964. The area also had 354 acres of soybeans and 23 acres of lespedeza. In addition to the cropland, the acreage included 50 acres of wildlands and about 100 acres in reservoirs for wildlife and aquatic life studies. A grass airstrip, available for aerial spraying, is located within the area. (Figure 7.)

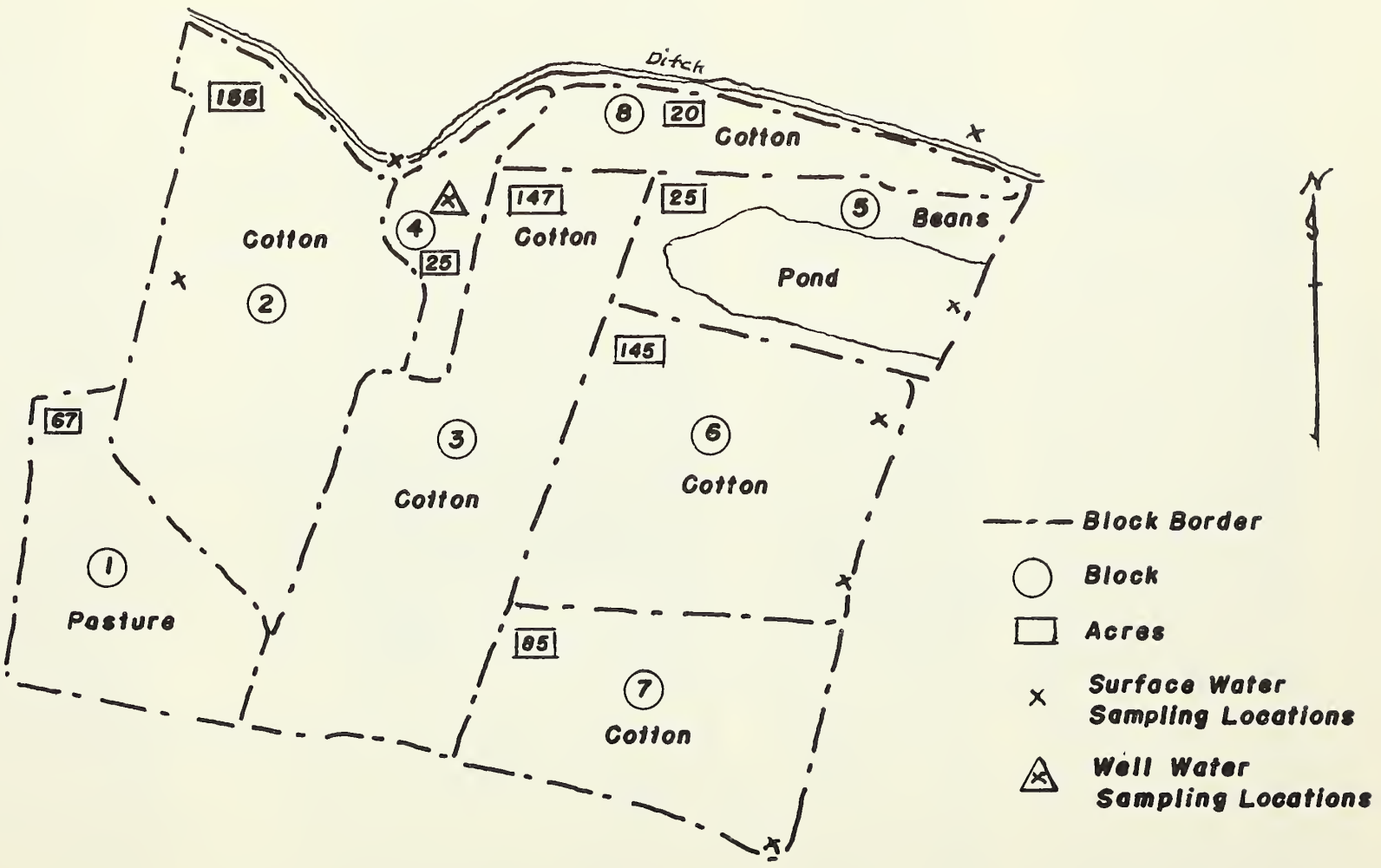
SCB
Ditch
185
8
20
Cotton
147
25
5
Beans
4
Cotton
25
Pond
2
Cotton
145
67
3
Cotton
6
Cotton
1
Pasture
85
7
Cotton
N
Block Border
Block
Acres
Surface Water Sampling Locations
Well Water Sampling Locations

Figure 6

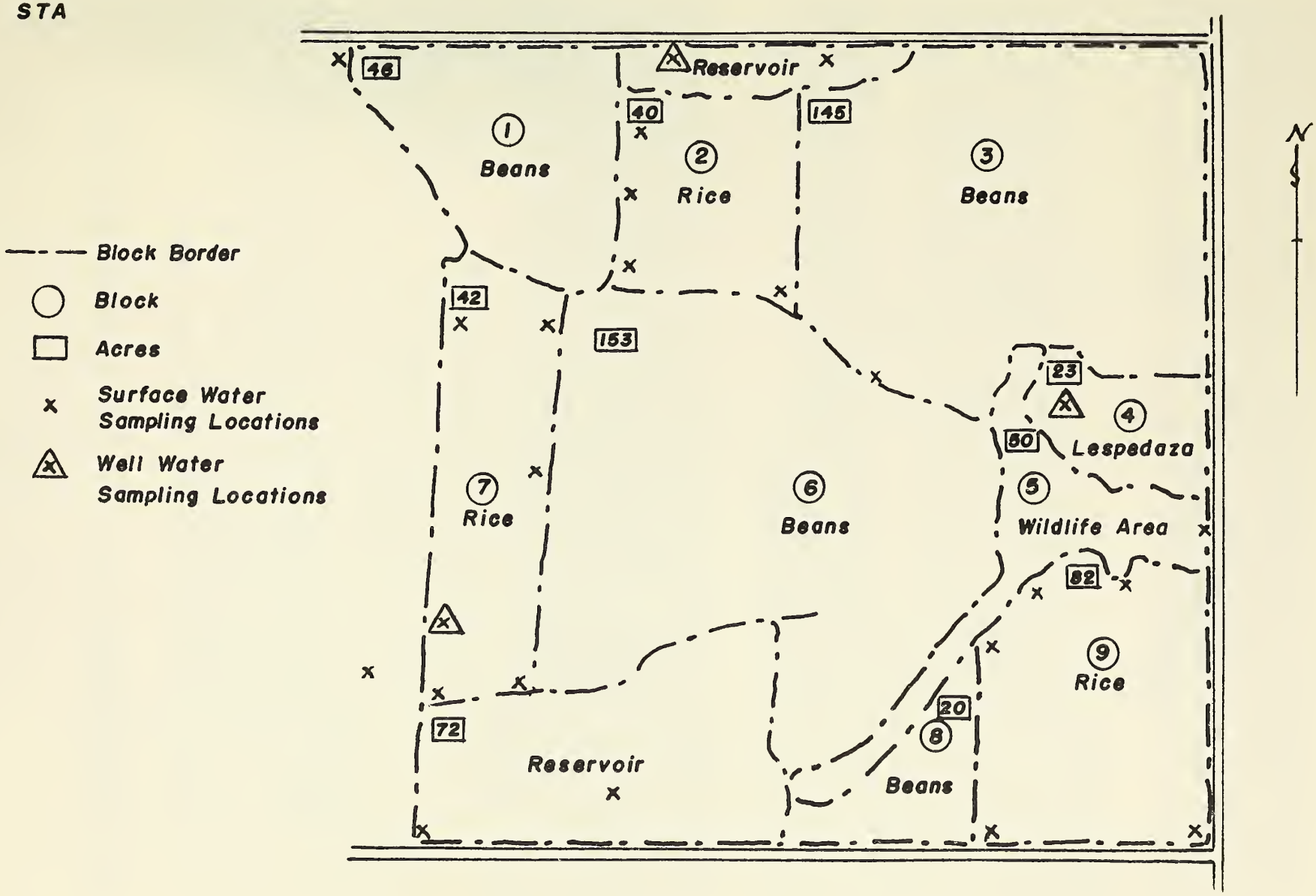
Block Border
Block
Acres
Surface Water Sampling Locations
Well Water Sampling Locations
46
Reservoir
40
145
1
Beans
2
Rice
3
Beans
42
153
23
4
Lespedaza
60
7
Rice
6
Beans
5
Wildlife Area
82
9
Rice
20
8
Beans
72
Reservoir
N

Figure 7

Weather data for study area STA are given in table 31 at end of report.

Pesticide application in rice in 1964 included aldrin and Panogen (methylmercury dicyandiamide) as seed treatments. Stam (3', 4', -dichloropropionanilide) was used for weed control on 40 acres of the rice crop. One application of toxaphene at a rate of 1.33 lb. per acre and one application of DDT at a rate of 0.67 lb. actual per acre were applied to soybeans for control of corn earworm. The lespedeza also received one application of toxaphene at the rate of 1.33 lb. per acre.[1]

B. Description of Soil

The dominant soils are on nearly level to gently sloping uplands. They have grayish-brown silt loam surface layers 6 to 8 inches thick, a markedly lighter colored gray subsurface layer of similar texture extending to about 18 inches, and a gray clayey subsoil mottled with red. This layer is commonly called a claypan. The subsoil grades into mottled-gray and brown silty-clay substratum at a depth of about $3\frac{1}{2}$ feet. This layer commonly extends to depths of several to many feet. These soils are strongly acid in both the surface layer and subsoil but become less acid in the substratum. They are low in plant nutrients. The very slowly permeable subsoil (claypan) is their most unfavorable feature.

The less extensive soils on nearly level terraces along streams have brown silt loam surface layers and somewhat finer textured yellowish-brown subsoils, which are very firm and mottled in the lower part (fragipan). The substratum beginning at about $3\frac{1}{2}$ feet is loamy. These soils are acid throughout and are low to medium in plant nutrients. The slowly permeable lower subsoil (fragipan) is their main unfavorable feature.

C. Analytical Results

Arsenic levels are substantially lower than those residues encountered in the Greenville and Scott areas of Mississippi. Aldrin and dieldrin residues were found at average levels of 0.01 p.p.m. or less, which may be attributed to the low rate of aldrin used as a seed treatment. Dieldrin residues were detectable only in soil while aldrin was detected in surface water sources during November and December but only at levels in the 0.02 to 0.07 p.p.b. range. Residue levels of DDT were low in soil and sediment; however, this material had been applied on the area for a total of 6 years since 1956. BHC/lindane was found at very low levels in surface water throughout the season, but treatment records do not indicate this material had been used in this area. Its presence is unexplainable.

Tables 32 to 34 at end of report present detailed analytical results.

Area STB

A. General Description

Area STB is similar to STA in cropping practices including pesticide use. In addition to the 469 acres under cultivation, the area contains a 116-acre lake and 39 acres in woodland. In 1964, rice was planted on 110 acres, soybeans on 198 acres, and oats on 161 acres. (Figure 8.) Investigations of pesticide-use practices on farms surrounding STB showed that chemical control in the area for rice and soybean production is closely similar to that on the study area. Methyl parathion was used, however, on two nearby farms.

Weather data for study area STB are given in table 35 at end of report.

[1] Ethyl parathion was introduced into the water at a rate of 0.037 lb. per acre for mosquito control.

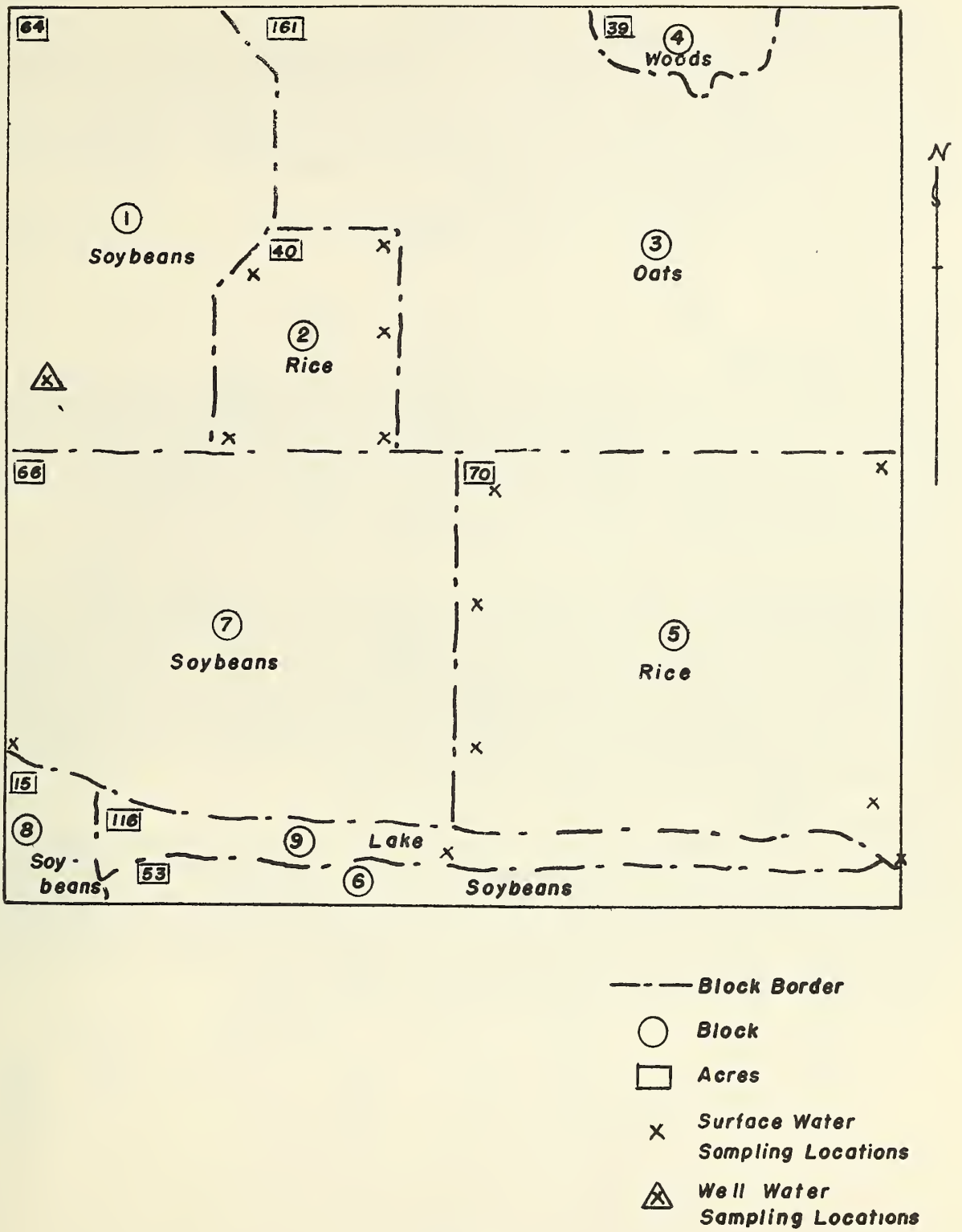
64
161
39
4
Woods
N
1
Soybeans
40
3
Oats
2
Rice
66
70
7
Soybeans
5
Rice
15
116
8
Soy-
beans
53
9
Lake
6
Soybeans
Block Border
Block
Acres
Surface Water
Sampling Locations
Well Water
Sampling Locations

Figure 8

B. Description of Soil

The soil types are the same in this study area as in STA.

C. Analytical Results

Arsenic levels were approximately the same as in the companion area STA. Only "low" levels of aldrin and dieldrin were detected in soil. As in STA, dieldrin residues are attributable to seed treatment with aldrin. DDT residues in soil were insignificant and detected in sediment only during the month of December. The presence of heptachlor epoxide in one sediment sample in July is unexplainable. Contamination of the sample may have occurred. As in STA, BHC/lindane was found in "low" amounts in water sources. Since irrigation water was involved, these low amounts could have originated outside of the area.

Tables 36 to 38 at end of report present detailed analytical data.

Area FBA

A. General Description

Area FBA, comprised of 632 acres, is located on Frenchman's Bayou near Wilson, Ark. Cotton, soybeans, and small grains are grown on this area. Woodland, water sources and pasture occupy about 120 acres of the area. (Figure 9) Preliminary investigations indicated this would be a suitable site for study of the normal use of agricultural pesticides of northeastern Arkansas; however, followup investigations and observations showed that the area had used only relatively small amounts of pesticides.

Weather data for study area FBA are given in table 39 at end of report.

B. Description of Soil

The dominant soils are clayey throughout. They have very dark grayish-brown to black surface layers and dark gray subsoils mottled with yellowish brown. These soils shrink and swell upon drying and wetting. When dry, they have cracks that extend to depths of 2 or 3 feet or more. These soils are near-neutral in reaction and they are medium to high in plant nutrients. The fine texture is their principal unfavorable feature. Narrow strips of less clayey soils are in narrow strips in sloughs and depressions and on flood plains of small streams. Light-colored, well-drained sandy soils are in narrow bands on natural levees.

C. Analytical Results

Arsenic residue levels in cropland indicate use of the material in past years. Analyses for chlorinated hydrocarbons were generally negative. Strobane/toxaphene residues at 0.4 to 0.5 p.p.m. levels were found in soil. The "low" residues of chlorinated hydrocarbons found in water and sediment are unexplainable since treatment records do not indicate application of these materials in recent years. Heptachlor epoxide and dieldrin residues in one sample of well water would appear to be due to contamination of the sample.

Tables 40 to 42 at end of report present detailed analytical results.

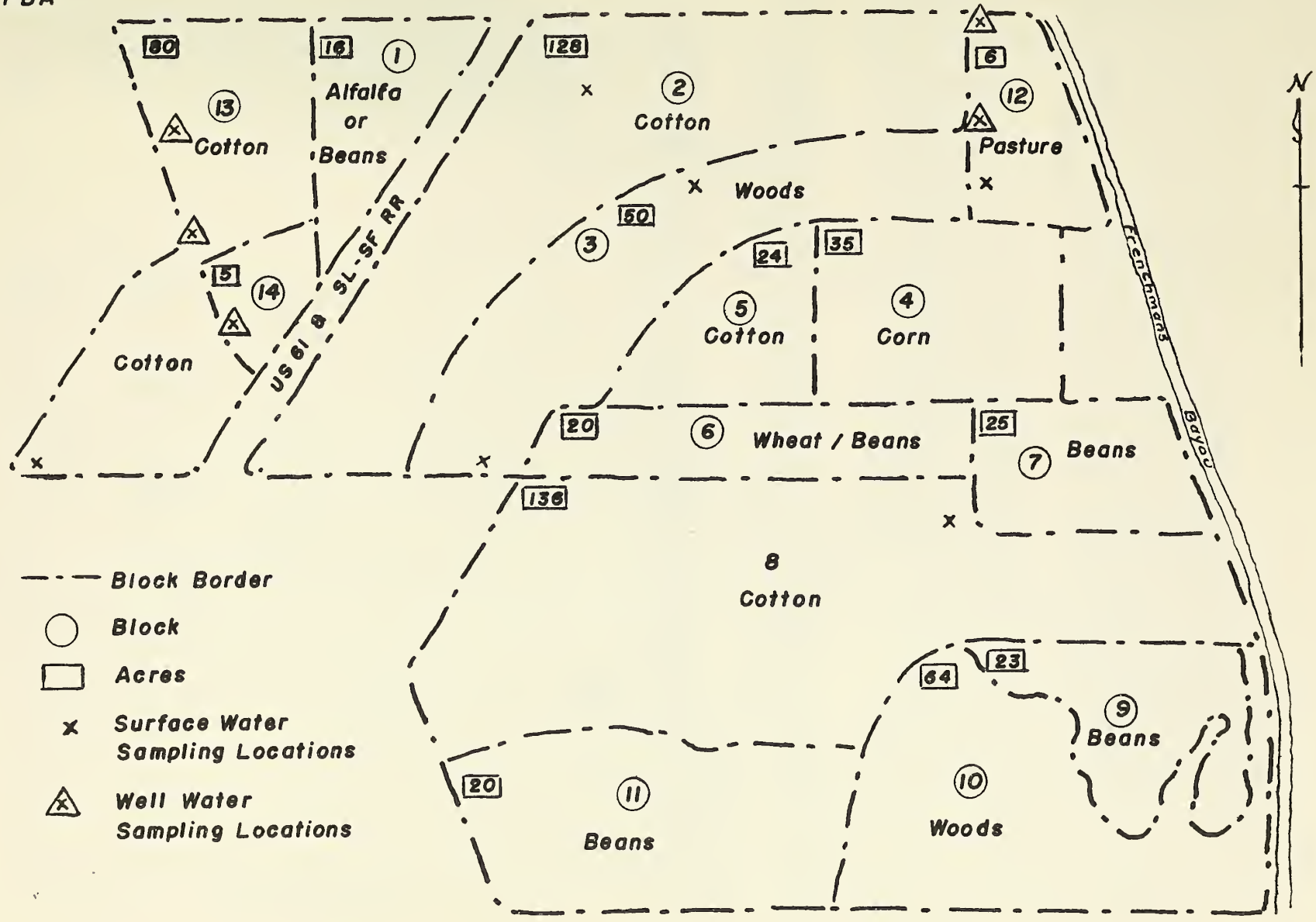
FBA
80
16
1
Alfalfa
or
Beans
13
Cotton
128
2
Cotton
6
12
Pasture
Woods
50
3
24
35
5
Cotton
4
Corn
15
14
Cotton
US 61 & SL-SF RR
Frenchmens Bayou
20
6
Wheat / Beans
25
7
Beans
136
8
Cotton
64
23
9
Beans
20
11
Beans
10
Woods
N
Block Border
Block
Acres
Surface Water Sampling Locations
Well Water Sampling Locations

Figure 9

Area FBB

A. General Description

Area FBB, comprised of 646 acres of cropland, is located near Wilson, Ark. (Figure 10). Cotton, soybeans, rice, and small grains are grown in rotation. Virtually no pesticides have been applied for the past 10 years in this intensive farming area according to operator reports. Investigations of pesticide-use practices on farms surrounding this area showed that some pesticides had been applied on each farm, except one, in at least 2 of the past 6 years. Materials used included toxaphene, DDT, and carbaryl. DDT and toxaphene were widely used in 1959, a year of heavy cotton insect populations. No farm in the surrounding areas reports use of DDT and toxaphene since 1960.

Weather data for study area FBB are presented in Table 43.

Areas FBA and FBB, representing agricultural practices where low pesticide-use is employed, have a place in a monitoring study for contrast and comparison purposes. Once an indication of the existing levels of residues in the environment have been established there would seem to be little reason to continue monitoring investigations on them unless farming practices are altered. This cannot be anticipated. Accordingly, these low-use study areas were dropped from the program.

B. Description of Soil

The soils in this area are very similar to those described for area FBA, except over about three-fourths of the area there is a thin layer of sandy material on the surface of the soil.

C. Analytical Results

The residue situation in this area is similar to that of FBA. A few samples of soil, water, and sediment were found to contain "low" amounts of dieldrin, DDT, endrin, or BHC/lindane.

Tables 44 to 46 at end of report present detailed analytical results.

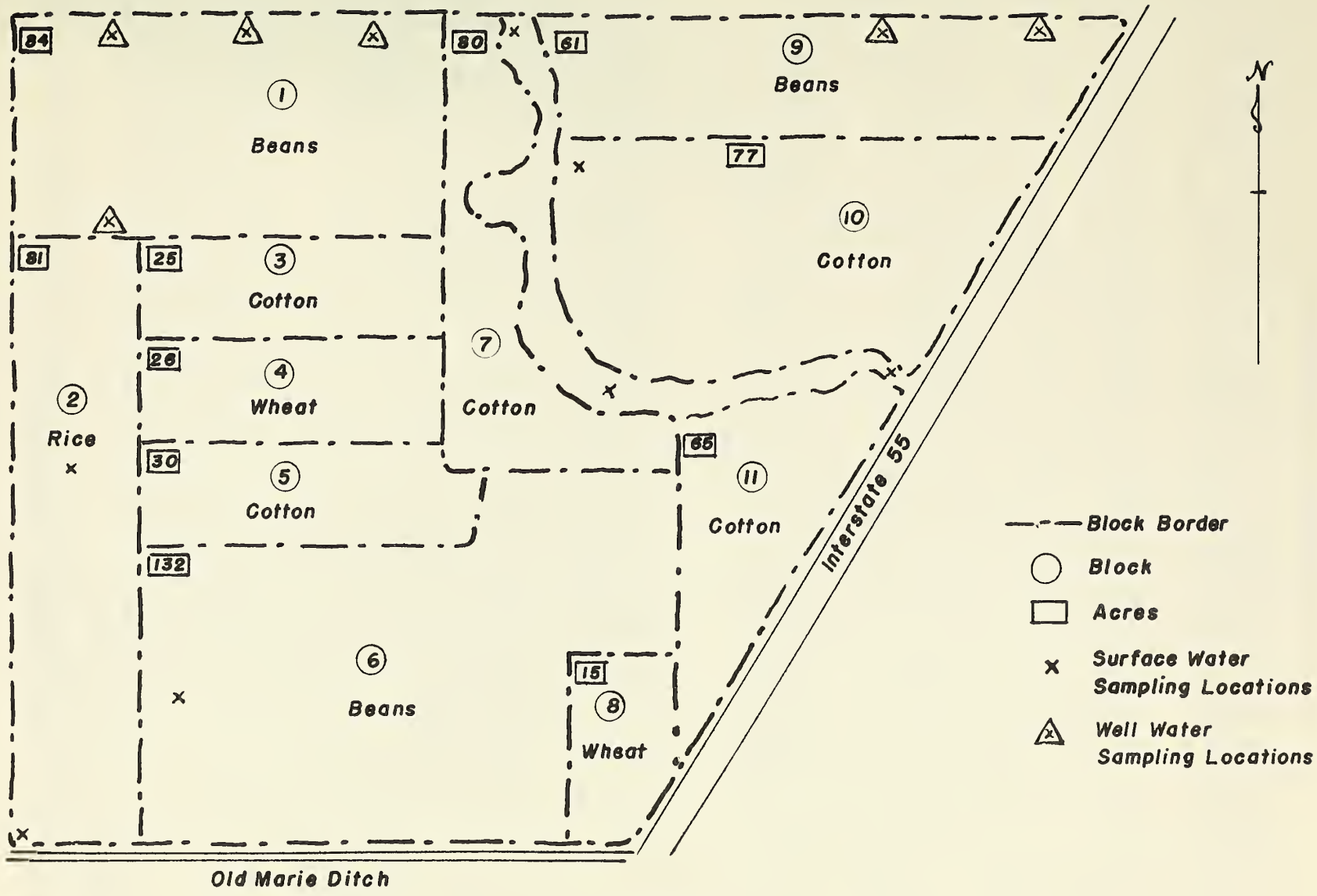
FBB
84
80
61
9
Beans
1
Beans
77
10
Cotton
81
25
3
Cotton
7
26
4
Wheat
Cotton
2
Rice
30
5
Cotton
65
11
Cotton
132
6
Beans
15
8
Wheat
Interstate 55
N
Block Border
Block
Acres
Surface Water Sampling Locations
Well Water Sampling Locations
Old Marie Ditch

Figure 10

DISCUSSION AND SUMMARY

A program to determine the effects of the normal use of agricultural pesticides on the environment was initiated in five locations in the lower Mississippi River Delta drainage area in May 1964. Each location was made up of two 1-square-mile study areas. Principal crops in the Mississippi areas were cotton and soybeans; major crops in Arkansas were rice and soybeans.

Pesticide-use practices were investigated and documented during the first season and samples were collected for residue analysis from various environmental media. Media sampled included soils, sediment, water, crops, livestock, and indicator species of land and aquatic animals.

The basic objective of this first year's work was the determination of existing levels of pesticide residues in the environment. This will serve as a base for studying trends of future accumulation or depletion.

This preliminary report covers studies on soil, sediment, and water. It involves two-thirds of all samples collected for chemical analysis during the year. Results of the operation at this early stage must be regarded as preliminary. They are adequate, however, to give indication of levels of pesticide residues in the physical environment of a farming region where large amounts of pesticides have been used for many years.

There appears to be little or no progressive buildup of any organic pesticide, chlorinated hydrocarbon, or phosphate, in soil, sediment, or water in this area. However, results on 1964 samples were not corrected for recovery. Accordingly, future reports will show higher residue levels. These should not be considered as an increase of buildup of residues.

Examples:

Area CHA A total of 32.59 lb. of DDT per acre were applied between 1955 and 1964. In 1964, 1.46 p.p.m., or approximately 1.5 lb. per acre were found in soil, 0.50 p.p.m. in sediment and nondetectable amounts in all except a few water samples as noted.

Area GRA An average of 12.9 applications of endrin, 0.21 lb. actual per acre, made each year since 1956. In 1964, an average of 0.05 was found in 156 soil samples; 0.11 p.p.m. in 55 sediment samples; 0.00012 to 0.0067 p.p.m.[2] in positive water samples.

Area SCB A total of 10.54 lb. per acre of endrin was applied during the period 1957-64. In 1964, an average of 0.34 p.p.m. was found in 71 soil samples; 2.56 p.p.m. in 56 sediment samples; and 0.00003 to 0.0175 p.p.m. in positive water samples.

Through the study, numerous examples were found of the lack of progressive accumulation of residues in the soil and water environment. There was, however, some evidence of a past buildup of arsenic in cultivated areas, presumably from use of calcium arsenate on cotton. The average arsenic content by area in cultivated fields ranged from 2.85 p.p.m. (CHB) to 12.9 p.p.m. (SCB), in uncultivated areas from 1.20 (CHA) to 5.90 p.p.m. (SCB).

Several factors limited the scope of the first year's analytical work. The most important of these concerned basic requirements such as staffing and equipment to initiate a large-scale program of this nature. Another factor involved the lack of readily available methods of analysis for the broad spectrum of pesticides used in the Delta area. Efforts were concentrated, therefore, on the chlorinated hydrocarbon insecticides and arsenic. Some work was also done on methyl parathion. Methyl parathion, endrin, and DDT at present are the principal cotton insecticides being used in the study areas. In 1965, the analytical work was expanded to cover additional pesticides, including herbicides.

[2] Although residues in water were determined in the p.p.b. (parts per billion) level, they are expressed in p.p.m. (parts per million) for reasons of uniformity in this summary.

Several major developments that have evolved from the 1964 study of the fate of principal insecticides in soils and water are of especial interest.

Aldrin and dieldrin have not been used as a foliar treatment for cotton insect control since about the mid-1950's in the study areas. Low amounts are still found, however, in the soil, sediment, and water. Seed treatments with aldrin could be a contributing factor to the widespread appearance of these materials in the analyses.

Where aldrin has been used as a seed treatment in rice production in a Stuttgart, Ark., area for the past years, detectable residues of aldrin were found in only 8 percent of the soil samples and dieldrin in about 35 percent. Average levels of aldrin in the positive samples for the two areas were 0.14 and 0.20 p.p.m.; the levels for dieldrin were 0.11 and 0.12 p.p.m. These levels are lower than the amount of material applied in any single application. Both compounds were nondetectable in sediment in both areas, except for one sample in which 0.11 p.p.m. aldrin was found. Dieldrin was not found in water in these areas; aldrin, however, was recovered in December and January samples at average levels of 0.00008 p.p.m.

BHC/lindane residues were determined in all 10 study areas, with the exception of area CHA, even though treatment histories indicate this material had not been applied in recent years. Residues of BHC/lindane, in general, were found at only "low" levels. The appearance of this material in surface water throughout the season in one of the Arkansas areas is unexplainable.

DDT, with its metabolites, was the pesticide most commonly found during this study. Cropland soil samples ranged from 16 to 100 percent positive, by area, with residue levels from 0.08 to 2.17 p.p.m. in positive samples. DDT was detected in water in 7 of the 10 areas. The levels, however, were well below 0.001 p.p.m. except in quick runoff samples where up to 0.017 p.p.m. was found. The compound was found in sediment to some extent in all areas with the highest reading of 0.95 to 1.4 p.p.m. found in the Greenville area. At the start of the program, it was expected that the residue content of sediment would follow closely the residue content in the soil from which the sediment originated. Such parallel was not found in the case of DDT. In soil analysis p,p-DDT was the dominant member of the DDT family. This is to be expected since this isomer makes up about 70 percent of technical DDT usually applied. In sediment samples, however, TDE was the dominant form of the DDT complex. In many sediment samples analyzed, o,p-DDT also exceeded the p,p-DDT.

Endrin has been used for cotton insect control for the past several years in three study areas. Over 10 lb. per acre of the material has been applied on a cumulative basis. The disappearance rate of this insecticide from treated fields is particularly noteworthy. Residue levels in positive samples ran from an average of 0.28 to 0.85 p.p.m. per acre with only 16 to 39 percent of the samples having detectable levels. Residue levels for all samples from treated fields averaged 0.04, 0.08, and 0.33 p.p.m. by area. Average levels of endrin residues in sediment for the sampling period, by area, were 0.10, 0.28, and 2.5 p.p.m. The increase in the levels of endrin in surface water of the three areas during the winter months is interesting. Average levels of 0.0146, 0.0174, and 0.00089 p.p.m. are recorded in the areas for January 1965. Average levels for any month during the growing season were less than 0.001 p.p.m. Quick runoff samples taken during January also contained relatively high levels of endrin. No quick runoff samples were taken during the summer months, therefore, comparison cannot be made in this type of water. In analysis of water from the standpoint of all pesticides, very little residues were found except in periods of heavy runoff.

Pesticide residue levels were studied in more detail in blocks where cotton was grown in 1964. Preseason and postseason samples were examined to determine the degree of accumulation following the 1964 treatment season. DDT, endrin, and methyl parathion were the principal insecticides used for cotton insect control in 1964. DDT appeared to accumulate during the control season in approximately the same ratio as the total seasonal application in three of four instances, the one exception being on GRB. Spring and fall samplings in 1965 should more

clearly define base residue levels and the degree at which DDT breaks down from one control season to the next. Examples of DDT application and residue levels 1964:

Study Areas	Total cumulative appl.	Preseason sample	Postseason sample
	Lb. per acre	P.p.m.	P.p.m.
CHA	1.79	1.32	2.19
CHB	1.84	.40	1.44
GRA	1.05	2.08	3.83
GRB	7.30	2.12	2.71

Endrin residues were similarly studied in cotton fields during 1964. Accumulation was not as pronounced, and postseason residue levels exceeded 1 p.p.m. only on SCB. This material appears to dissipate rather rapidly when applied as a foliar treatment for cotton insects. Examples of endrin application and residue levels 1964:

Study Areas	Total cumulative appl.	Preseason sample	Postseason sample
	Lb. per acre	P.p.m.	P.p.m.
GRA	2.25	0.01	0.44
SCA	1.96	.10	ND[1]
SCB	2.16	.15	1.41

[1] No detectable residue.

Too few samples were analyzed for methyl parathion to draw definite conclusions. It appears, however, that the material dissipates rapidly in the study areas.

Determination of Strobane/toxaphene residues were attempted in 1964 on a limited number of samples. Highest levels were found in areas with past histories of application as might be expected. In cultivated land, average levels range from 0.88 p.p.m. on CHB to 3.78 p.p.m. on GRB. The analytical results on these two chlorinated insecticides reported herein should be considered preliminary until additional studies on methodology have been completed.

Heptachlor, or its epoxide, was detected in a relatively small number of water and sediment samples. Both surface water and sediment on GRA contained residues. Residues also were detected in sediment on STB, and in surface and quick runoff water on SCB. In all cases, however, average levels in these media on study areas were extremely low and possible contamination of the sample could be blamed for residues that appeared in the analysis. No residues of heptachlor or heptachlor epoxide were detected in soil.

A number of samples of well water taken on CHA, CHB, GRB, FBA, and FBB were found to contain pesticide residues. On the latter two areas, aldrin (0.00008 p.p.m.), dieldrin (0.00004 to 0.00019 p.p.m.), DDT (0.000008 p.p.m.), BHC/lindane (0.000008 to 0.000115 p.p.m.), and heptachlor or heptachlor epoxide (0.00008 p.p.m.) were found during the early summer in one of the two areas, with only dieldrin being reported in both areas. DDT (0.000205 to 0.00023 p.p.m.) was present in well water samples on GRA in July and September, and BHC/lindane (0.00023 p.p.m.) was present in the May-June samples. In addition, one sample of well water contained 0.005 p.p.m. of Strobane/toxaphene in July. On CHB, December-January samples of well water had some DDT (0.00016 p.p.m.) and 0.0019 p.p.m. of endrin.

The presence of these residues in well water is unexplainable. Additional samples were taken in 1965 to confirm the 1964 findings.

LIST OF PESTICIDES IN TABLES

Listed in alphabetical order are the pesticides used in the tables and narrative portions of this report. Common names as approved by the Terminology Committees of the Entomological Society of America and the Weed Society of America are used where possible. Most other chemicals are listed alphabetically under their commonly used trade or proprietary names. These names begin with capital letters. The remaining compounds are listed by their abbreviated chemical names. In all instances, pesticides are classed according to the principal biological activity and chemical definitions are given.

aldrin--Insecticide. Not less than 95 percent of 1, 2, 3, 4, 10, 10-hexachloro-1, 4, 4a, 5, 8, 8a-hexahydro-1, 4,-endo-exo-5, 8-dimethanonaphthalene.

Arsenic--Insecticide and herbicide. Analysis of arsenical compounds based on determination of inorganic or elemental arsenic.

BHC--benzene hexachloride. Insecticide. 1, 2, 3, 4, 5, 6-hexachlorocyclohexane, consisting of several isomers and containing a specific percentage of gamma. Lindane must be not less than 99 percent pure gamma isomer of BHC.

calcium cyanimide--Herbicide, defoliant, and fungicide. $CaCN_2$.

captan--Fungicide. N-(trichloromethylthio)-4-cyclohexane-1, 2-dicarboximide.

carbaryl--Insecticide. 1-naphthyl methylcarbamate.

CIPC--Herbicide. isopropyl N-(3-chlorophenyl) carbamate.

dalapon--Herbicide. 2, 2-dichloropropionic acid.

DDT--Insecticide. 1, 1, 1, -trichloro-2, 2-bis(p-chlorophenyl) ethane. The initials "DDT" have come, by common usage, to stand for the mixture of the isomers of dichlorodiphenyl-trichloroethane of which the para-para isomer makes up not less than 60 percent to 70 percent.

DEF®--Defoliant. s, s, s-tributyl phosphorotrithioate.

dieldrin--Insecticide. Not less than 85 percent of 1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy- 1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4-endo-exo-5, 8-dimethanonaphthalene.

diuron--Herbicide. 3-(3, 4-dichlorophenyl)-1, 1-dimethylurea.

DSMA--Herbicide. disodium methanearsonate.

endrin--Insecticide. 1, 2, 3, 4, 10, 10-hexachloro-6, 7-epoxy-1, 4, 4a, 5, 6, 7, 8, 8a-octahydro-1, 4-endo-endo-5, 8-dimethanonaphthalene.

Ethyl parathion--See parathion.

Guthion®--Insecticide. 0, 0-dimethyl S-[4-oxo-1, 2, 3-benzotriazin-3(4H)-ylmethyl] phosphorodithioate.

heptachlor--Insecticide. 1, 4, 5, 6, 7, 8, 8-heptachloro-3a, 4, 7, 7a-tetrahydro-4, 7-methanoindene.

heptachlor epoxide--Insecticide. Oxidation product of heptachlor formed after application.

lindane--Insecticide. See BHC.

malathion--Insecticide. S-[1, 2-bis(ethoxycarbonyl) ethyl] 0, 0-dimethyl phosphorodithioate.

Merphos--See DEF®.

methyl parathion--Insecticide. 0, 0-dimethyl 0-p-nitrophenyl phosphorothioate.

Panogen--Fungicide. methylmercury dicyandiamide.

parathion--Insecticide. 0, 0-diethyl 0-p-nitrophenyl phosphorothioate.

propanil--Herbicide. 3', 4'-dichloropropionanilide.

simazine--Herbicide. 2-chloro-4, 6-bis(ethylamino)-s,-triazine.

sodium chlorate--Herbicide. $NaClO_3$.

Strobane®--Insecticide. terpene polychlorinates containing about 65 percent chlorine.

Stam--See propanil.

sulfur--Fungicide and acaricide.

toxaphene--Insecticide. chlorinated camphene containing 67 to 69 percent chlorine.

2,4-D- Herbicide. 2, 4-dichlorophenoxyacetic acid.

2,4,5-T - Herbicide, 2,4,5-trichlorophenoxyacetic acid.

Table 1.--Weather data for study area CHA

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964.....	May	85.00	60.09	--	--	2.01
	June	87.03	64.18	--	--	1.72
	July	90.25	69.01	--	--	10.16
	Aug.	91.02	69.30	--	--	3.27
	Sept.	88.25	63.05	90.24	38.08	4.16
	Oct.	77.29	49.01	89.06	34.17	7.66
	Nov.	73.18	48.20	86.16	38.11	9.14
	Dec.	64.13	43.20	87.19	45.10	8.06
1965.....	Jan.	73.13	44.14	88.30	44.10	2.92
	Feb.	62.13	39.11	88.08	40.12	6.58

Table 2.--History of pesticide application and residue levels in soils

[ND = no residues detected]

AREA CHA: 203 acres cropland, 380 uncultivated

Pesticide	Years applied	Average application per year	Cumulative amount applied[1]	Average rate per application (actual)	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residue per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
BHC/lindane:[2]								
Cropland (183 A. treated)..	1955-63	--	7.30	--	72	0.02	19.44	0.12
Uncultivated.....		--	--	--	70	.01	2.85	.23
DDT:								
Cropland (203 A. treated)..	1955-64	--	32.59	--	0.72	1.46	84.72	1.72
Uncultivated.....		--	--	--	0.70	0.36	35.71	0.10
Dieldrin:								
Cropland (23 A. treated)...	1958	--	0.80	--	72	0.01	6.94	0.09
Uncultivated.....		--	--	--	70	0.01	8.57	0.14
Endrin:								
Cropland (80 A. treated)...	1962	--	.62	--	72	--	0	ND
Uncultivated.....		--	--	--	70	--	0	ND
Methyl Parathion:[2]								
Cropland (203 A. treated)..	1958-64	--	15.00	--	--	--	--	[3] 0.29
Uncultivated.....		--	--	--	--	--	--	[4] 0.12
Arsenic:								
Cropland (203 A. treated)..		--	--	--	34	2.93	100	2.93
Uncultivated.....		--	--	--	31	1.20	100	1.20
Carbaryl								
Cropland (50 A. treated)...	1963	--	2.00	--	--	--	--	--
Uncultivated.....		--	--	--	--	--	--	--
DEF:								
Cropland (80 A. treated)...	1964	--	0.95	--	--	--	--	--
Uncultivated.....		--	--	--	--	--	--	--
Malathion:								
Cropland (110 A. treated)..	1955-58	--	4.41	--	--	--	--	--
Unclutivated.....		--	--	--	--	--	--	--
Parathion:								
Cropland (160 A. treated)..	1955-59	--	2.25	--	--	--	--	--
Uncultivated.....		--	--	--	--	--	--	--
Strobane/toxaphene:[3]	1958,							
Cropland (153 A. treated)	1960-64	--	42.41	--	--	--	--	[5] 2.10
Uncultivated.....		--	--	--	--	--	--	--

[1] "Explanation of Tables", see item 1, p. 5. [2] "Explanation of Tables", see item 3, p. 5. [3] 8 samples. [4] 3 samples. [5] 17 samples.

Table 3.--Pesticide application and residue levels in cotton fields

[ND = no residues detected]

AREA CHA: Four blocks, 148 acres

Pesticide	Pesticide application, 1964			Average amount residue per sample	
	Applications per field	Average rate per application (actual)	Cumulative amount[1] applied	June 1964	January 1965
	Lb./A.	Lb./A.	Lb./A.	P.p.m.	P.p.m.
BHC/lindane[2].....	--	--	--	0.10	[4] ND
DEF (80 A. treated)....	1.5	0.75	0.94	--	--
DDT.....	3.7	0.77	1.79	1.32	2.19
Methyl parathion.....	12.2	0.42	5.16	--	--
Strobane/toxaphene.....	3.25	1.75	5.71	--	--

[1] See "Explanation of Tables", item 1, p. 5 .
[2] See "Explanation of Tables", item 4, p. 5 .

Table 4.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC = no samples collected]

AREA CHA

Pesticide	May, June 1964			July 1964			August 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
BHC/lindane[1].....	ND	0.56	NSC	ND	0.01	NSC	ND	ND	NSC
Dieldrin.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
DDT.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
Endrin.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
Heptachlor and/or heptachlor epoxide...	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC

Pesticide	September 1964			Dec. 1964 to Jan. 1965			Avg. May 1964 to Jan. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	ND	ND	ND	ND	ND	ND	--	--	--
BHC/lindane[1].....	ND	ND	ND	ND	ND	ND	--	0.05	--
Dieldrin.....	ND	ND	ND	ND	ND	ND	--	--	--
DDT.....	ND	ND	ND	ND	ND	0.37	--	--	0.37
Endrin.....	ND	ND	ND	ND	ND	ND	--	--	--
Heptachlor and/or heptachlor expoxide..	ND	ND	ND	ND	ND	ND	--	--	--

[1] See "Explanation of Tables", item 4, p. 5.

Table 5.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources--average parts per million

[ND = no residues detected]

AREA CHA

Pesticide	May, June 1964	July 1964	August 1964	September 1964	October 1964	December 1964	January 1965	February 1965	Average[1] May to Feb.
Samples collected.. (number)	4	7	8	8	1	2	8	2	[2] 40
Aldrin.....	ND	ND	ND	0.02	ND	ND	ND	ND	< 0.01
BHC/lindane[3].....	ND	0.02	ND	ND	ND	ND	ND	ND	< 0.01
Dieldrin.....	ND	0.02	ND	0.01	ND	ND	ND	ND	< 0.01
DDT.....	0.07	0.12	0.04	0.25	ND	1.98	0.48	4.50	0.50
Endrin.....	ND	0.10	ND	ND	ND	ND	ND	0.04	0.02
Heptachlor.....	ND	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor epoxide.	ND	ND	ND	ND	ND	ND	ND	ND	--
Methyl parathion[4]..	--	[5] 0.28	--	--	--	--	--	--	--
Strobane/toxaphene[4]	--	--	--	[5] 2.00	--	--	--	--	--
Sulfur[2].....	--	--	--	--	--	--	[6] 13.51	--	--

[1] Average of pesticides May 1964 to Feb. 1965.
[2] Total samples collected, May 1964 to February 1965.
[3] See "Explanation of Tables", item 4, p. 5.
[4] See "Explanation of Tables", item 3, p. 5.
[5] 1 sample.
[6] 5 samples.

Table 6.--Weather data for study area CHB

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964.....	May	85.00	60.09	--	--	2.01
	June	90.03	66.24	--	--	1.72
	July	90.25	69.01	--	--	10.16
	Aug.	91.02	69.30	--	--	3.27
	Sept.	88.25	63.05	90.24	38.08	4.40
	Oct.	77.29	49.01	88.07	34.16	6.69
	Nov.	71.17	45.05	93.02	48.04	10.72
	Dec.	60.20	39.03	92.14	54.05	7.81
1965.....	Jan.	58.29	36.05	92.21	43.19	2.14
	Feb.	57.24	36.02	92.06	44.03	5.28

Table 7.--History of pesticide application and residue levels in soils

[ND = no residues detected]

AREA CHB: 145 Acres Cropland, 400 uncultivated

Pesticide	Years applied	Average application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residues per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
BHC/lindane[2]:								
Cropland (135 A. treated)	1955-58	3.4	0.31	3.56	70	<0.01	1.42	0.08
Uncultivated	--	--	--	--	84	ND	0	--
DDT:								
Cropland (140 A. treated)	1955-64	2.4	0.61	11.04	70	0.5	67.14	0.75
Uncultivated	--	--	--	--	84	0.09	15.47	0.60
Endrin:								
Cropland (125 A. treated)	1958	3.0	0.20	0.59	70	ND	0	ND
Uncultivated	--	--	--	--	84	ND	0	ND
Methyl parathion[3]:								
Cropland (140 A. treated)	1957, 1959-64	5.8	0.40	11.81				[4] 0.17
Uncultivated	--	--	--	--	--	--	--	[5] 0.10
Strobane/toxaphene[3]:								
Cropland (135 A. treated)	1955, 57	1.9	2.00	17.56				[6] 0.88
Uncultivated	--	--	--	--	--	--	--	[7] 0.33
Arsenic:								
Cropland (145 A. treated)					33	2.85	100	2.85
Uncultivated	--	--	--	--	43	2.68	100	2.68
Dieldrin:								
Cropland					70	<0.01	5.71	0.08
Uncultivated	--	--	--	--	84	<0.01	2.38	0.08
DEF:								
Cropland (70 A. treated)	1964	1.0	0.75	0.75	--	--	--	--
Uncultivated	--	--	--	--	--	--	--	--
Guthion:								
Cropland (70 A. treated)	1964	2.0	0.25	0.50	--	--	--	--
Uncultivated	--	--	--	--	--	--	--	--
Malathion:								
Cropland (30 A. treated)	1957	3.0	1.00	3.00	--	--	--	--
Uncultivated	--	--	--	--	--	--	--	--

[1] See "Explanation of Tables", item 1, p. 5.
[2] See "Explanation of Tables", item 4, p. 5.
[3] See "Explanation of Tables", item 3, p. 5.
[4] 6 samples. [5] 4 samples. [6] 15 samples. [7] 3 samples.

Table 8.--Pesticide application and residue levels in cotton fields

AREA CHB: Two blocks, 100 A.

Pesticide	Pesticide application, 1964			Average amount residue per sample	
	Applications per field	Average rate per application (actual)	Cumulative amount[1] applied	June 1964	January 1965
		Lb./A.	Lb./A.	P.p.m.	P.p.m.
DEF (70 A. treated)	1	0.75	0.75	--	--
DDT	4	0.46	1.84	0.40	1.44
Guthion (70 A. treated)	2	0.25	0.50	--	--
Methyl parathion	8	0.30	2.40	--	--

[1] See "Explanation of Tables", item 1, p.

Table 9.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC no samples collected]

AREA CHB

Pesticide	May, June 1964			July 1964			August 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
BHC/lindane	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
Dieldrin	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
DDT	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
Endrin	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC
Heptachlor and/or heptachlor epoxide	ND	ND	NSC	ND	< 0.01	NSC	ND	ND	NSC

Pesticide	September 1964			Dec. 1964 to Jan. 1965			Avg. May 1964 to Jan. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin	NSC	ND	NSC	ND	NSC	ND	--	--	--
BHC/lindane	NSC	ND	NSC	ND	NSC	ND	--	--	--
Dieldrin	NSC	ND	NSC	ND	NSC	ND	--	--	--
DDT	NSC	ND	NSC	0.16	NSC	ND	0.04	--	--
Endrin	NSC	ND	NSC	1.87	NSC	ND	0.47	--	--
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	ND	NSC	ND	--	--	--

Table 10.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

[ND = no residues detected]

AREA CHB

Pesticide	May, June 1964	July 1964	August 1964	September 1964	December 1964	January 1965	February 1965	Average[1] May to Feb.
Samples collected (number)	4	5	8	9	2	7	2	[2] 37
Aldrin	ND	ND	ND	ND	ND	ND	ND	--
BHC/lindane[3]	ND	ND	ND	ND	ND	ND	ND	--
Dieldrin	ND	ND	0.02	ND	ND	ND	ND	<0.01
DDT	0.04	ND	0.08	ND	0.40	0.10	0.89	0.11
Endrin	ND	ND	0.02	ND	ND	ND	ND	<0.01
Heptachlor	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	--
Strobane/toxaphene[4]	--	--	[5]6.00	--	--	--	--	--
Sulfur[4]	--	--	--	--	--	[6]10.10	[5]0.05	--

[1] Average of pesticides, May 1964 to Feb. 1965. [2] Total samples collected, May 1964 to Feb. 1965. [3] See "Explanation of Tables", item 4, p. 5. [4] See "Explanation of Tables", item 3, p. 5. [5] 1 sample. [6] 5 samples.

Table 11.--Weather data for study area GRA

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964	May	85.28	62.22	--	--	1.48
	June	92.12	69.06	93.05	38.11	1.30
	July	92.24	71.11	98.29	44.26	2.30
	Aug.	89.27	69.28	99.17	50.28	5.09
	Sept.	86.11	63.13	98.11	47.16	2.86
	Oct.	72.28	47.07	97.21	40.27	0.96
	Nov.	67.03	45.10	98.04	50.29	4.36
	Dec.	55.22	39.12	96.28	60.18	5.04
1965	Jan.	56.01	37.02	95.11	52.14	2.36
	Feb.	55.02	36.16	95.11	51.26	7.29
	March	54.12	40.05	96.01	58.09	3.14
	April	77.13	58.13	97.16	47.02	2.65

Table 12.--History of pesticide application and residue levels in soils

[ND = no residues detected]

AREA GRA: 502 acres cropland, 100 acres uncultivated

Pesticide	Years applied	Average number application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residues per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
Arsenic:								
Cropland		--	--	--	84	4.31	100	4.31
Uncultivated		--	--	--	8	3.64	100	3.64
Aldrin:								
Cropland	1952-53	6.5	0.19	--	156	ND	0	--
Uncultivated		--	--	--	12	ND	0	--
Dieldrin:								
Cropland	1954-55	7.0	0.10	--	156	0.02	25	0.10
Uncultivated		--	--	--	12	ND	0	--
DDT:								
Cropland	1948-55, 1959, 1964	6.4	1.00	--	156	1.23	82.69	1.49
Uncultivated		--	--	--	12	0.07	16.66	0.41
Endrin:								
Cropland	1956-64	12.9	0.21	--	156	0.05	16.02	0.29
Uncultivated		--	--	--	12	ND	0	--
Methyl parathion[2]:								
Cropland	1958-64	13.3	0.23	--	--	--	--	[3] 0.04
Uncultivated		--	--	--	--	--	--	[4] 0.08
Toxaphene[2]:								
Cropland	1953-54, 1964	2.8	1.16	--	--	--	--	[5] 3.51
Uncultivated		--	--	--	--	--	--	[4] 1.70
BHC/lindane[6]:								
Cropland	1948-55, 1959	6.0	0.30	--	156	0.10	9.61	0.12
Uncultivated		--	--	--	12	ND	0	ND
Other pesticides applied to cropland:								
Carbaryl (86 A. treated)	1964	1.0	1.50	--	--	--	--	--
Calcium cyanimide	1959-63	1.0	17.00	--	--	--	--	--
Diuron	1959-63	1.5	1.40	--	--	--	--	--
Malathion	1956	9.0	0.50	--	--	--	--	--
Merphos	1959-63	1.6	0.76	--	--	--	--	--

[1] Cumulative amount applied per acre of cropland cannot be computed as records not available on specific fields treated prior to 1959. [2] See "Explanation of Tables," item 3, p. 5. [3] 4 samples. [4] 1 sample. [5] 40 samples. [6] See "Explanation of Tables," item 4, p. 5.

Table 13.--Pesticide application and residue levels in cotton fields

AREA GRA: Four blocks, 388 acres

Pesticide	Pesticide application, 1964			Average amount residue per sample	
	Applications per field	Average rate per application (actual)	Cumulative amount[1] applied	June 1964	January 1965
		Lb./A.	Lb./A.	P.p.m.	P.p.m.
DDT	1.75	0.06	1.05	2.08	3.83
Endrin	7.5	0.30	2.25	0.01	0.44
Toxaphene	2.0	1.0	2.0	--	--
Methyl parathion	11.2	0.36	4.03	--	--
Calcium cyanimide (230 A. treated)	1.0	17.00	--	--	--
Diuron (396 A. treated)	1.0	0.8	--	--	--
Merphos (333 A. treated)	1.6	0.74	--	--	--

[1] See "Explanation of Tables", item 1, p. 5.

Table 14.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC = no samples collected]

AREA GRA

Pesticide	May, June 1964			July 1964			August 1964			September 1964			November 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
BHC/lindane[1].....	ND	0.08	NSC	ND	ND	NSC	ND	0.04	NSC	ND	ND	NSC	NSC	0.02	NSC
Dieldrin.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
DDT.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Endrin.....	ND	ND	NSC	ND	ND	NSC	ND	0.12	NSC	ND	ND	NSC	NSC	ND	NSC
Heptachlor and/or heptachlor epoxide	ND	ND	NSC	ND	ND	NSC	ND	0.01	NSC	ND	ND	NSC	NSC	ND	NSC
Strobane/toxaphene[2]	--	--	NSC	--	--	NSC	--	--	NSC	--	--	NSC	NSC	[3] 0.10	NSC

Pesticide	December 1964			January 1965			February 1965			Avg. May 1964 to Feb. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	NSC	ND	NSC	ND	ND	ND	ND	ND	ND	--	--	--
BHC/lindane[1].....	NSC	ND	NSC	ND	ND	ND	ND	0.01	ND	--	0.02	--
Dieldrin.....	NSC	ND	NSC	ND	0.05	ND	ND	ND	0.06	--	<0.01	0.01
DDT.....	NSC	ND	NSC	ND	0.4	0.4	ND	0.06	0.70	--	0.07	0.44
Endrin.....	NSC	ND	NSC	ND	0.87	6.70	ND	0.23	0.67	--	0.19	5.20
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	ND	ND	ND	ND	ND	ND	--	<0.01	--
Strobane/toxaphene[2]	NSC	--	NSC	--	--	[4]0.83	--	--	--	--	--	--

[1] See "Explanation of Tables", item 4, p. 5. [2] See "Explanation of Tables", item 3, p. 5.
[3] 1 sample. [4] 2 samples.

Table 15.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

[ND = no residues detected]

AREA GRA

Pesticide	May, June 1964	July 1964	August 1964	September 1964	October 1964	November 1964	December 1964	January 1965	February 1965	Average[1] May to Feb.
Samples collected (number).....	4	10	8	6	1	3	4	11	8	[2] 55
Aldrin.....	ND	ND	ND	ND	ND	ND	0.03	ND	ND	<0.01
Dieldrin.....	ND	0.04	0.07	0.01	ND	0.11	0.05	<0.01	0.01	0.03
DDT.....	0.50	0.44	0.45	0.43	ND	2.49	1.26	1.44	1.32	0.94
Endrin.....	ND	0.04	0.01	0.09	ND	1.33	0.06	0.06	ND	0.11
Heptachlor.....	0.03	<0.01	ND	ND	ND	ND	ND	ND	ND	<0.01
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
BHC/lindane[3].....	0.06	<0.01	0.01	<0.01	ND	ND	ND	0.09	ND	0.03
Strobane/ toxaphene[4].....	--	[5]3.50	--	[5] 3.00	--	--	--	[6] 3.15	0.04	--
Sulfur[3].....	--	--	--	--	--	--	--	--	[7] 2.50	--

[1] Average of pesticides May 1964 to Feb. 1965.
[2] Total samples collected, May 1964 to Feb. 1965.
[3] See "Explanation of Tables", item 4, p. 5.
[4] See "Explanation of Tables", item 3, p. 5.
[5] 1 sample.
[6] 2 samples.
[7] 3 samples.

Table 16.--Weather data for study area GRB

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964.....	May	85.28	62.22	--	--	1.48
	June	92.12	68.16	65.08	28.07	1.16
	July	92.24	71.11	98.29	44.26	3.86
	Aug.	90.10	69.26	96.11	49.13	3.40
	Sept.	87.29	62.23	95.25	42.18	4.64
	Oct.	72.28	47.07	97.21	40.27	0.68
	Nov.	67.11	44.27	98.04	50.29	4.32
	Dec.	56.27	41.05	96.05	64.15	4.62
1965.....	Jan.	55.09	36.25	94.08	57.18	2.37
	Feb.	54.24	36.10	93.15	54.21	5.69
	March	54.14	39.10	94.12	60.05	5.24

Table 17.--History of pesticide application and residue levels in soils

[ND = no residues detected]

AREA GRB: 577 acres cropland, 70 acres uncultivated

Pesticide	Years applied	Average application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples postive	Average amount residues per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
Dieldrin:								
Cropland treated[2].....	1957-58	([3])	([3])	1.80	96	<0.01	7.29	0.11
Uncultivated (70 A.).....	--	--	--	--	12	ND	0	--
DDT:								
Cropland (317 A. treated).	1959-64	10.0	0.55	22.84	48	2.17	100	2.17
Cropland (260 A. untr.)...	--	--	--	--	48	0.28	47.91	0.58
Uncultivated.....	--	--	--	--	12	0.28	58.33	0.48
Endrin:								
Cropland treated[2].....	1957-58	([3])	([3])	6.00	96	0.01	5.20	0.15
Uncultivated.....	--	--	--	--	12	ND	0	--
Methyl parathion[4]:								
Cropland (396 A. treated).	1959-64	9.3	0.30	4.91	--	--	--	[5] 0.35
Cropland (181 A. untr.)...	--	--	--	--	--	--	--	--
Uncultivated (70 A.).....	--	--	--	--	--	--	--	[6] 0.19
Strobane/toxaphene[4]:								
Cropland (330 A. treated).	1960	([3])	([3])	1.90	--	--	--	[7] 3.78
Uncultivated (70 A.).....	--	--	--	--	--	--	--	[8] 1.24
Arsenic[9]:								
Cropland (577 A. treated).	--	--	--	--	51	8.37	100	8.39
Uncultivated (70 A.).....	--	--	--	--	8	2.83	100	2.83
BHC/lindane[10]:								
Cropland.....	--	--	--	--	96	0.01	7.29	0.08
Uncultivated.....	--	--	--	--	12	ND	0	--

[1] See "Explanation of Tables", item 1, p. 5.
[2] Number of acres treated not reported.
[3] Records on number and rate of application not available.
[4] See "Explanation of Tables", item 3, p. 5.
[5] 5 samples.
[6] 2 samples.
[7] 12 samples.
[8] 1 sample.
[9] DSMA (disodium methanearsonate) applied on 44 acres 1964, 1 application at 1 lb. per acre. Records on use of sodium chlorate and diuron, 1964, included in table 18. Pesticide use history in area GRB may not be complete.
[10] See "Explanation of Tables", item 4, p. 5.

Table 18.--Pesticide application and residue levels in cotton fields

AREA GRB

Pesticide	Pesticide application, 1964			Average amount residue per sample	
	Applications per field	Average rate per application (actual)	Cumulative amount[1] applied	June 1964	January 1965
		Lb./A.	Lb./A.	P.p.m.	P.p.m.
Arsenic.....	[2] 1.0	1.00	1.00	--	--
DDT.....	9.6	.76	7.3	2.12	2.71
Diuron (131 A. treated)	1.0	.75	0.75	--	--
Methyl parathion.....	9.6	.24	2.3	--	--
Sodium chlorate (277 A. treated).....	1.0	3.0	3.0	--	--

[1] See "Explanation of Tables", item 1, p. 5.
[2] 44 acres of cotton received 1 application of DSMA in 1964.

Table 19.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residue detected; NSC = no samples collected]

AREA GRB

Pesticide	May, June 1964			July 1964			August 1964			September 1964			November 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
BHC/lindane[1].....	0.23	0.18	NSC	ND	0.07	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Dieldrin.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
DDT.....	ND	ND	NSC	0.21	ND	NSC	ND	ND	NSC	0.20	ND	NSC	NSC	ND	NSC
Endrin.....	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	0.09	NSC
Heptachlor and/or heptachlor epoxide	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Strobane/toxaphene[2]	--	--	NSC	[3] 5.00	--	NSC	--	--	NSC	--	--	NSC	NSC	[3] 8.65	NSC

Pesticide	January 1965			February 1965			Avg. May 1964 to Feb. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	NSC	ND	ND	NSC	ND	ND	--	--	--
BHC/lindane[1].....	NSC	0.02	ND	NSC	ND	ND	0.06	0.03	--
Dieldrin.....	NSC	0.02	ND	NSC	0.03	ND	--	< 0.01	--
DDT.....	NSC	0.73	0.86	NSC	0.68	1.78	0.13	0.16	1.41
Endrin.....	NSC	2.04	5.13	NSC	0.03	0.02	--	0.33	2.06
Heptachlor and/or heptachlor epoxide	NSC	ND	ND	NSC	ND	ND	--	--	--
Strobane/toxaphene[2]	NSC	--	--	NSC	--	--	--	--	--

[1] See "Explanation of Tables", item 4, p. 5.
[2] See "Explanation of Tables", item 3, p. 5.
[3] 1 sample.

Table 20.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

AREA GRB [ND = no residue detected]

Pesticide	May, June 1964	July 1964	August 1964	September 1964	October 1964	November 1964	January 1965	February 1965	Average[1] May to Feb.
Samples collected (number)	3	9	7	6	2	3	8	6	[2] 44
Aldrin	ND	ND	ND	ND	ND	0.05	ND	0.03	< 0.01
BHC/lindane[3]	ND	<0.01	0.01	ND	0.04	ND	0.10	ND	0.02
Dieldrin	ND	<0.01	0.02	0.04	ND	0.03	0.01	ND	0.01
DDT	0.13	1.06	0.59	1.35	0.49	1.94	2.35	2.91	1.48
Endrin	ND	ND	0.05	ND	ND	ND	ND	ND	< 0.01
Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND	--
Strobane/toxaphene[4]	--	--	--	[5] 3.67	--	--	[6] 7.10	[7] 1.20	--
Sulfur[4]	--	--	--	--	--	--	--	[8] 2.89	--

[1] Average pesticides May 1964 to Feb. 1965.
[2] Total samples collected, May 1964 to Feb. 1965.
[3] See "Explanation of Tables", item 4, p. 5.
[4] See "Explanation of Tables", item 3, p. 3.
[5] 3 samples. [6] 2 samples. [7] 6 samples. [8] 6 samples.

Table 21.--Weather data for study area SCA

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964	May	85.28	62.22	100.00	--	4.25
	June	92.12	65.77	100.00	--	0.50
	July	92.23	71.11	--	--	4.98
	Aug.	90.10	69.26	--	--	1.97
	Sept.	85.20	62.14	99.18	63.13	1.92
	Oct.	72.14	47.12	100.00	55.24	0.03
	Nov.	67.17	45.11	99.25	69.09	4.84
	Dec.	55.08	38.00	100.00	84.06	5.50
1965	Jan.	55.07	35.16	99.13	65.19	2.79

Table 22.--History of pesticide application and residue levels in soils

[ND = no residues detected]

AREA SCA: 550 acres cropland, 66 acres uncultivated

Pesticide	Years applied	Average application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residues per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
Arsenic:								
Cropland (397 A. treated)..	1964 (DSMA)	--	--	0.58	28	10.28	100	10.28
Cropland (153 A. untr.)....		--	--	--	25	10.69	100	10.69
Uncultivated.....		--	--	--	7	4.76	100	4.76
DDT:								
Cropland (506 A. treated)..	1958-62	--	--	19.70	83	1.70	97.59	1.74
Cropland (44 A. untr.).....		--	--	--	24	0.76	75.00	1.02
Uncultivated (66 A.).....		--	--	--	11	0.11	36.36	0.30
Endrin:	1957-58,							
Cropland (506 A. treated...	1960-64	--	--	12.80	83	0.09	26.50	0.33
Cropland (44 A. untr.).....		--	--	--	24	0.04	16.66	0.22
Uncultivated (66 A.).....		--	--	--	11	ND	0	--
Methyl parathion:[2]								
Cropland (506 A. treated)..	1958-64	--	--	22.57	--	--	--	[3] 0.29
Uncultivated (66 A.).....		--	--	--	--	--	--	[4] 0.16
Toxaphene:[2]	1958-59,							
Cropland (471 A. treated)..	1962	--	--	11.88	--	--	--	[5] 2.89
Aldrin:								
Cropland.....		--	--	--	107	0.01	14.95	0.09
Uncultivated.....		--	--	--	11	ND	0	--
Dieldrin:								
Cropland.....		--	--	--	107	0.04	33.64	0.10
Uncultivated.....		--	--	--	11	ND	0	--
BHC/lindane:[6]								
Cropland.....		--	--	--	107	0.01	12.14	0.08
Uncultivated.....		--	--	--	11	ND	0	--
Sulfur:[2]								
Cropland.....		--	--	--	--	--	--	[7] 2.72
Calcium cyanimide:								
Cropland (466 A. treated)..	1959-60	--	--	21.27	--	--	--	--
Carbaryl:								
Cropland (464 A. treated)..	1960	--	--	0.19	--	--	--	--
CIPC:								
Cropland (416 A. treated)..	1960	--	--	2.09	--	--	--	--
Ethyl parathion:								
Cropland (431 A. treated)..	1958	--	--	0.27	--	--	--	--
Dalapon:	1962,							
Cropland (466 A. treated)..	1964	--	--	8.92	--	--	--	--
Diuron:	1960,							
Cropland (456 A. treated)..	1961-62	--	--	3.13	--	--	--	--
Karmex:								
Cropland (466 A. treated)..	1958-61	--	--	0.62	--	--	--	--
Merphos								
Cropland (397 A. treated)..	1961-64	--	--	2.86	--	--	--	--
Simazine:								
Cropland (466 A. treated)..	1960	--	--	0.09	--	--	--	--
Sodium chlorate								
Cropland (466 A. treated)..	1958-60	--	--	5.41	--	--	--	--

[1] See "Explanation of Tables," item 1, p. 5.
[2] See "Explanation of Tables," item 3, p. 5.
[3] 5 samples.
[4] 3 samples.
[5] 24 samples.
[6] See "Explanation of Tables," item 4, p. 5.
[7] 11 samples.

Table 23.--Pesticide application and residue levels in cotton fields

AREA SCA: Four blocks, 397 acres

Pesticide	Pesticide application, 1964			Average amount residue per sample	
	Applications per field	Average rate per application	Cumulative amount applied[1]	June 1964	January 1965
		Lb./A.	Lb./A.	P.p.m.	P.p.m.
Arsenic	[2] 1.25	0.45	0.58	--	--
Dalapon (161 A. only)	1	15.00	15.00	--	--
Diuron	2.25	0.67	1.51	--	--
Endrin	8	0.245	1.96	0.10	ND
Merphos	1	1.125	1.125	--	--
Methyl parathion	8	.29	2.32	--	--

[1] See "Explanation of Tables", item 1, p. 5.
[2] DSMA (disodium methanearsonate).

Table 24.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC = no samples collected]

AREA SCA

Pesticide	May, June 1964			July 1964			August 1964			September 1964			November 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
BHC/lindane[1]	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	0.02	NSC	NSC	ND	NSC
Dieldrin	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
DDT	NSC	0.37	NSC	ND	0.13	NSC	ND	ND	NSC	ND	0.37	NSC	NSC	ND	NSC
Endrin	NSC	ND	NSC	ND	0.17	NSC	ND	0.89	NSC	ND	0.04	NSC	NSC	ND	NSC
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Strobane/toxaphene[2]	NSC	--	NSC	--	--	NSC	--	--	NSC	--	--	NSC	NSC	--	NSC

Pesticide	December 1964			January 1965			February 1965			Avg. May 1964 to Feb. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin	NSC	ND	NSC	ND	ND	ND	NSC	ND	ND	--	--	--
BHC/lindane[1]	NSC	0.08	NSC	ND	ND	ND	NSC	ND	ND	--	0.01	--
Dieldren	NSC	ND	NSC	ND	0.08	0.02	NSC	ND	0.40	--	<0.01	0.03
DDT	NSC	0.14	NSC	ND	0.40	0.85	NSC	0.04	0.18	--	0.14	0.62
Endrin	NSC	ND	NSC	ND	14.60	13.81	NSC	0.03	0.68	--	0.66	9.44
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	ND	ND	ND	NSC	ND	ND	--	--	--
Strobane/toxaphene[2]	NSC	--	NSC	ND	--	[4] 1.17	NSC	--	--	--	--	--

[1] See "Explanation of Tables", item 4, p. 5.
[2] See "Explanation of Tables", item 3, p. 5.
[3] 1 sample.
[4] 2 samples.

Table 25.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

AREA SCA [ND = no residues detected]

Pesticide	May, June 1964	July 1964	August 1964	September 1964	October 1964	November 1964	December 1964	January 1965	February 1965	Average[1] May to Feb.
Samples collected (number).....	2	7	9	5	3	4	5	6	4	[2] 45
Aldrin.....	ND	0.01	ND	ND	ND	0.08	0.02	ND	0.07	0.02
BHC/lindane[3].....	ND	ND	ND	ND	0.03	0.03	0.03	ND	ND	<0.01
Dieldrin.....	ND	0.06	0.05	0.08	0.03	0.14	0.11	0.05	0.07	0.07
DDT.....	ND	1.16	0.95	0.87	1.27	2.15	1.96	1.40	2.16	1.34
Endrin.....	ND	0.13	0.09	0.17	ND	1.40	0.97	ND	ND	0.29
Heptachlor.....	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor epoxide.....	ND	ND	ND	ND	0.03	ND	ND	ND	ND	< 0.01
Strobane/ toxaphene[4].....	--	--	[5] 3.00	[6] 4.40	[6] 2.10	--	--	[7] 4.24	[6] 1.30	--
Sulfur[4].....	--	[5] 9.50	--	--	--	--	--	--	[8] 2.48	--

[1] Average pesticides May 1964 to Feb. 1965.
[2] Total samples collected, May to Feb. 1965.
[3] See "Explanation of Tables", item 4, p. 5.
[4] See "Explanation of Tables", item 3, p. 5.
[5] 1 sample.
[6] 2 samples.
[7] 5 samples.
[8] 4 samples.

Table 26.--Weather data for study area SCB

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964.....	May	85.28	62.22	100.00	--	3.94
	June	92.12	69.12	--	--	0.98
	July	92.23	71.11	--	--	3.39
	Aug.	90.10	69.26	--	--	1.88
	Sept.	85.16	61.09	99.18	59.09	1.51
	Oct.	72.14	47.12	100.00	55.24	0.04
	Nov.	64.01	44.05	99.25	67.17	4.02
	Dec.	55.15	37.24	99.18	72.19	5.98
1965.....	Jan.	57.12	36.26	99.27	65.16	4.10

Table 27.--History of pesticide application and residue levels in soils

AREA SCB: 577 acres cropland, 67 acres uncultivated

Pesticide	Years applied	Average application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residues per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
Arsenic:								
Cropland treated.....	1964 (DSMA)	--	--	0.45	41	12.90	100	12.90
Uncultivated.....		--	--	--	6	5.90	100	5.90
DDT:	1958-60,							
Cropland (577 A. treated).	1962	--	--	6.42	71	1.97	97.18	2.03
Uncultivated (67 A.).....		--	--	--	13	0.84	92.30	0.91
Endrin:								
Cropland (577 A. treated).	1957-64	--	--	10.54	71	0.34	39.43	0.86
Uncultivated (67 A.).....		--	--	--	13	0.02	7.69	0.28
Aldrin:								
Cropland treated.....		--	--	--	71	<0.01	2.81	0.08
Uncultivated.....		--	--	--	13	<0.01	7.69	0.08
Dieldrin:								
Cropland treated.....		--	--	--	71	0.05	50.70	0.10
Uncultivated.....		--	--	--	13	0.04	15.38	0.24
Methyl parathion[2]:								
Cropland (577 A. treated).	1958-64	--	--	15.27	--	--	--	[3] 0.18
Uncultivated (67 A.).....		--	--	--	--	--	--	--
Toxaphene:[2]	1958-59,							
Cropland (577 A. treated).	1962	--	--	3.74	--	--	--	[4] 1.93
Uncultivated.....		--	--	--	--	--	--	[5] 0.20
Calcium cyanimide:								
Cropland (552 A. treated).	1959-60	--	--	15.97	--	--	--	--
Cropland (25 A. untr.)....		--	--	--	--	--	--	--
Uncultivated (67 A.).....		--	--	--	--	--	--	--
Carbaryl:								
Cropland (557 A. treated).	1960	--	--	0.97	--	--	--	--
Cropland (25 A. untr.)....		--	--	--	--	--	--	--
Uncultivated (67 A.).....		--	--	--	--	--	--	--
CIPC:								
Cropland (552 A. treated)..	1960	--	--	3.54	--	--	--	--
Cropland (25 A. untr.).....		--	--	--	--	--	--	--
Uncultivated (67 A.).....		--	--	--	--	--	--	--
Diuron:	1958-62,							
Cropland (577 A. treated)..	1964	--	--	2.67	--	--	--	--
Uncultivated (67 A.).....		--	--	--	--	--	--	--
Malathion:								
Cropland (155 A. treated)..	1959	--	--	0.72	--	--	--	--
Cropland (422 A. untr.)....		--	--	--	--	--	--	--
Uncultivated (67 A.).....		--	--	--	--	--	--	--
Merphos:								
Cropland (552 A. treated)..	1961-63	--	--	3.04	--	--	--	--
Cropland (25 A. untr.).....		--	--	--	--	--	--	--
Uncultivated (67 A.).....		--	--	--	--	--	--	--
Simazine:								
Cropland (552 A. treated)..	1960	--	--	0.08	--	--	--	--
Cropland (25 A. untr.).....		--	--	--	--	--	--	--
Uncultivated (67 A.).....		--	--	--	--	--	--	--
Sodium chlorate:								
Cropland (577 A. treated)..	1958-60	--	--	3.78	--	--	--	--
Uncultivated (67 A.).....		--	--	--	--	--	--	--

[1] See "Explanation of Tables", item, 1, p. 5.
[2] See "Explanation of Tables", item, 3, p. 5.
[3] 6 samples.
[4] 16 samples.
[5] 1 sample.

Table 28.--Pesticide application and residue levels in cotton fields

AREA SCB: 549 acres, 5 fields

Pesticide	Pesticide application 1964			Average amount residue per sample	
	Applications per field	Average rate per application (actual)	Cumulative amount applied[1]	June 1964	January 1965
		Lb./A.	Lb./A.	P.p.m.	P.p.m.
Diuron	1.6	1.3	2.0	--	--
Endrin	9.4	0.23	2.16	0.15	1.41
Merphos	1	1.19	1.19	--	--
Methyl parathion	9.4	0.28	2.63	--	--

[1] See "Explanation of Tables", item 1, p, 5.

Table 29.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC = no samples collected]

AREA SCB

Pesticide	May, June 1964			July 1964			August 1964			September 1964			November 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin	NSC	ND	NSC	ND	ND	0.08	ND	0.28	NSC	ND	NSC	NSC	NSC	ND	NSC
BHC/lindane[1]	NSC	ND	NSC	ND	ND	ND	ND	ND	NSC	ND	NSC	NSC	NSC	ND	NSC
Dieldrin	NSC	ND	NSC	ND	ND	0.81	ND	0.32	NSC	ND	NSC	NSC	NSC	ND	NSC
DDT	NSC	ND	NSC	ND	0.07	1.21	ND	2.62	NSC	ND	NSC	NSC	NSC	ND	NSC
Endrin	NSC	ND	NSC	ND	ND	0.52	ND	0.03	NSC	ND	NSC	NSC	NSC	ND	NSC
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	ND	ND	0.08	ND	0.03	NSC	ND	NSC	NSC	NSC	ND	NSC
Strobane/toxaphene[2]	NSC	--	NSC	--	--	[3] 2.48	--	[3] 1.50	NSC	--	NSC	NSC	NSC	[3] 1.84	NSC

Pesticide	December 1964			January 1965			February 1965			Avg. May 1964 to Feb. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin	NSC	ND	NSC	NSC	ND	ND	NSC	NSC	ND	--	0.03	0.01
BHC/lindane[1]	NSC	0.03	NSC	NSC	ND	0.01	NSC	NSC	ND	--	<0.01	<0.01
Dieldrin	NSC	0.05	NSC	NSC	0.06	0.02	NSC	NSC	0.10	--	0.06	0.16
DDT	NSC	0.34	NSC	NSC	1.42	2.53	NSC	NSC	0.33	--	0.72	1.71
Endrin	NSC	0.31	NSC	NSC	17.46	7.29	NSC	NSC	0.69	--	4.23	4.44
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	NSC	ND	ND	NSC	NSC	ND	--	--	--
Strobane/toxaphene[2]	NSC	--	NSC	NSC	[4] 3.65	0.90	NSC	NSC	--	--	--	--

[1] See "Explanation of Tables", item 4, p. 5.
[2] See "Explanation of Tables", item 3, p. 5.
[3] 1 sample. [4] 4 samples.

Table 30.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

AREA SCB [ND = no residues detected]

Pesticide	May, June 1964	July 1964	August 1964	September 1964	October 1964	November 1964	December 1964	January 1965	February 1965	Average May to Feb.[1]
Samples collected (number).....	4	9	9	8	2	3	3	10	8	[2] 56
Aldrin.....	0.02	ND	ND	ND	ND	0.05	2.34	ND	ND	0.13
BHC/lindane[3].....	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
Dieldrin.....	ND	0.02	0.04	0.01	ND	0.07	0.69	0.22	0.09	0.10
DDT.....	0.44	0.43	0.81	0.53	0.26	1.68	3.23	1.11	1.37	0.97
Endrin.....	ND	0.10	0.04	0.10	ND	2.82	32.44	3.15	0.62	2.56
Heptachlor.....	ND	ND	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor epoxide	0.06	ND	ND	ND	ND	ND	ND	ND	ND	<0.01
Strobane/ toxaphene[4].....	--	--	--	--	--	--	--	[5] 2.36	[6] 3.10	--
Sulfur[4].....	--	[7] 0.08	--	--	--	--	--	--	[5] 2.39	--

[1] Average pesticides, May 1964 to Feb. 1965.
[2] Total samples collected, May 1964 to Feb. 1965.
[3] See "Explanation of Tables", Item 4, p. 5.
[4] See "Explanation of Tables", Item 3, p. 5.
[5] 7 samples.
[6] 1 sample.
[7] 2 samples.

Table 31.--Weather data for study area STA

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964.....	May	85.08	63.13	--	--	0.40
	June	90.00	69.07	--	--	1.07
	July	92.10	71.12	--	--	3.79
	Aug.	88.22	69.21	--	--	3.49
	Sept.	85.06	61.17	98.10	54.21	3.71
	Oct.	72.15	45.09	100.00	46.04	0.34
	Nov.	66.07	44.12	98.11	53.24	3.59
	Dec.	55.18	38.14	99.15	65.18	5.89
1965.....	Jan.	54.12	35.02	98.09	58.20	3.88
	Feb.	54.10	34.11	0.99	55.01	6.35

Table 32.--History of pesticide application and residue levels in soils

[ND = no residues detected]

AREA STA: 552 acres cropland, 50 acres uncultivated

Pesticide	Years applied	Average application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residues per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
Aldrin:								
Cropland (529 A. treated)..	1958-64	1.0	0.39	0.77	72	<0.01	4.16	0.14
Cropland (23 A. untr.).....		--	--	--	12	ND	0	--
Uncultivated (50 A.).....		--	--	--	12	ND	0	--
Dieldrin:								
Cropland treated.....		--	--	--	72	0.01	11.11	0.11
Cropland untreated.....		--	--	--	12	ND	0	--
Uncultivated.....		--	--	--	12	ND	0	--
DDT:								
Cropland (467 A. treated)..	1956, 1959-60, 1962-64	1.0	0.67	1.56	52	0.13	36.53	0.34
Cropland (108 A. untr.)....		--	--	--	32	<0.01	6.25	0.10
Uncultivated (50 A.).....		--	--	--	12	0.04	16.66	0.26
Arsenic:								
Cropland.....		--	--	--	44	4.35	100	4.35
Uncultivated.....		--	--	--	6	2.40	100	2.40
Toxaphene:								
Cropland (490 A treated)...	1956, 1959-60, 1962-64	1.0	1.33	2.98	--	--	--	--
Panogen:								
Cropland (552 A. treated)..	1956-64	1.0	0.002	--	--	--	--	--
Stam:								
Cropland (259 A. treated)..	1962-64	1.0	9.00	--	--	--	--	--

[1] See "Explanation of Tables", item 1, p. 5.

Table 33.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC = no samples collected]

AREA STA

Pesticide	May, June 1964			July 1964			August 1964			September 1964			November 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	NSC	ND	NSC	ND	ND	NSC	NSC	ND	NSC	ND	ND	NSC	NSC	0.07	NSC
BHC/lindane[1].....	NSC	0.21	NSC	ND	0.02	NSC	NSC	0.04	NSC	ND	0.02	NSC	NSC	0.02	NSC
Dieldrin.....	NSC	ND	NSC	ND	ND	NSC	NSC	<0.01	NSC	ND	ND	NSC	NSC	ND	NSC
DDT.....	NSC	0.53	NSC	ND	ND	NSC	NSC	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Endrin.....	NSC	ND	NSC	ND	ND	NSC	NSC	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	ND	ND	NSC	NSC	ND	NSC	ND	ND	NSC	NSC	ND	NSC

Pesticide	December 1964			January 1965			February 1965			Avg. May to Feb.		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	NSC	0.02	ND	ND	ND	NSC	ND	ND	ND	--	<0.01	--
BHC/lindane[1].....	NSC	0.02	0.08	ND	ND	NSC	ND	0.02	0.06	--	0.03	0.07
Dieldrin.....	NSC	ND	ND	ND	ND	NSC	ND	ND	ND	--	<0.01	--
DDT.....	NSC	ND	ND	ND	ND	NSC	ND	ND	ND	--	0.03	--
Endrin.....	NSC	ND	ND	ND	ND	NSC	ND	ND	ND	--	--	--
Heptachlor and/or heptachlor epoxide	NSC	ND	ND	ND	ND	NSC	ND	ND	ND	--	--	--

[1] See "Explanation of Tables", item 4, p. 5.

Table 34.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

AREA STA [ND = no residues detected]

Pesticide	May, June 1964	July 1964	August 1964	September 1964	October 1964	December 1964	January 1965	February 1965	Average May to Feb.[1]
Samples collected (number)	2	11	7	5	1	2	6	6	[2] 40
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND	--
BHC/lindane[3]	ND	ND	ND	ND	ND	ND	ND	ND	--
Dieldrin	ND	ND	ND	ND	ND	ND	ND	ND	--
DDT	ND	ND	0.16	ND	ND	0.34	ND	0.02	0.05
Endrin	ND	ND	0.03	ND	ND	ND	ND	ND	<0.01
Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND	--
Strobane/toxaphene[4]	--	--	[5] 0.60	--	--	--	--	--	--
Sulfur[4]	--	--	--	--	--	--	[6] 25.94	[7] 10.53	--

[1] Average pesticides, May 1964 to Feb. 1965.
[2] Total samples collected, May 1964 to Feb. 1965
[3] See "Explanation of Tables", item 4, p. 5.
[4] See "Explanation of Tables", item 3, p. 5.
[5] 1 sample.
[6] 4 samples.
[7] 3 samples.

Table 35.--Weather data for study area STB

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964	May	85.08	63.13	--	--	0.40
	June	90.00	69.07	--	--	1.51
	July	92.10	71.12	--	--	4.62
	Aug.	88.22	69.21	--	--	4.60
	Sept.	85.14	62.07	98.10	54.21	3.86
	Oct.	71.29	45.00	100.00	46.04	3.79
	Nov.	65.18	43.14	97.19	50.10	3.74
	Dec.	52.29	35.28	94.26	58.22	7.60
1965	Jan.	53.09	33.24	98.04	59.26	4.27
	Feb.	53.10	32.20	100.00	59.17	6.72

Table 36.--History of pesticide application and residue levels in soils

[ND = no residues detected]

AREA STB: 469 acres cropland, 39 acres uncultivated

Pesticide	Years applied	Average application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residues per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
Aldrin:								
Cropland (469 A. treated)..	1959, 1961-64	1.0	0.50	0.65	77	0.02	7.79	0.20
Uncultivated (39 A.).....	--	--	--	--	12	ND	0	--
Dieldrin:								
Cropland (469 A. treated)..	--	--	--	--	77	0.04	35.06	0.12
Uncultivated (39 A.).....	--	--	--	--	12	ND	0	--
DDT:								
Cropland (293 A. treated)..	1964	1.2	0.69	1.07	49	0.03	16.32	0.20
Cropland (179 A. untr.)....	--	--	--	--	28	ND	0	--
Uncultivated (39 A.).....	--	--	--	--	12	0.01	17.00	0.08
Arsenic:								
Cropland (469 A. treated)..	--	--	--	--	39	4.84	100	4.84
Uncultivated (39 A.).....	--	--	--	--	8	3.51	100	3.51
Strobane/toxaphene[2]:								
Cropland (293 A. treated)..	1964	1.2	1.30	--	--	--	--	[3] 2.45
Captan:								
Cropland (130 A. treated)..	1964	1.5	0.06	--	--	--	--	--
Ethyl parathion:								
Cropland (110 A. treated)..	1964	2.0	0.21	--	--	--	--	--
Panogen:								
Cropland (469 A. treated)..	1956-64	1.1	0.002	--	--	--	--	--
Stam:								
Cropland (110 A. treated)..	1964	1.0	3.50	--	--	--	--	--
2,4-D:								
Cropland (106 A. treated)..	1962-63	1.0	0.75	--	--	--	--	--
2,4-5-T:								
Cropland (331 A. treated)..	1961-64	1.0	1.37	--	--	--	--	--

[1] See "Explanation of Tables", item 1, p. 5. [2] See "Explanation of Tables", item 3, p. 5. [3] 2 samples.

Table 37.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC = no samples collected]

AREA STB

Pesticide	May, June 1964			July 1964			August 1964			September 1964			December 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	0.08	ND
BHC/lindane[1].....	NSC	0.10	NSC	ND	0.09	NSC	ND	0.25	NSC	ND	ND	NSC	NSC	ND	0.08
Dieldrin.....	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	ND
DDT.....	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	ND
Endrin.....	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	ND
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	ND	ND	NSC	ND	ND	NSC	ND	ND	NSC	NSC	ND	ND

Pesticide	January 1965			February 1965			Avg. May 1964 to Feb. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	NSC	ND	NSC	NSC	ND	ND	--	<0.01	--
BHC/lindane[1].....	NSC	0.15	NSC	NSC	0.05	0.08	--	0.12	0.08
Dieldrin.....	NSC	ND	NSC	NSC	ND	ND	--	--	--
DDT.....	NSC	ND	NSC	NSC	ND	ND	--	--	--
Endrin.....	NSC	ND	NSC	NSC	ND	ND	--	--	--
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	NSC	ND	ND	--	--	--

[1] See "Explanation of Tables", item 1, p. 5.

Table 38.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

AREA STB [ND = no residues detected]

Pesticide	May, June 1964	July 1964	August 1964	September 1964	December 1964	January 1965	February 1965	Average[1] May to Feb.
Samples collected (number)..	1	4	2	2	1	3	3	[2] 16
Aldrin.....	ND	0.03	ND	ND	ND	ND	ND	<0.01
BHC/lindane[3].....	ND	ND	ND	ND	ND	ND	ND	--
Dieldrin.....	ND	ND	ND	ND	ND	ND	ND	--
DDT.....	ND	ND	ND	ND	0.11	ND	ND	<0.01
Endrin.....	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor.....	ND	0.02	ND	ND	ND	ND	ND	<0.01
Heptachlor epoxide.....	ND	0.04	ND	ND	ND	ND	ND	0.01
Sulfur[4].....	--	--	--	--	--	--	[5] 14.13	--

[1] Average pesticides, May 1964 to Feb. 1965.
[2] Total samples collected, May to Feb.
[3] See "Explanation of Tables", item 4, p. 5.
[4] See "Explanation of Tables", item 3, p. 5.
[5] 1 sample.

Table 39.--Weather data for study area FBA

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964.....	May	82.12	61.24	89.21	52.06	3.12
	June	90.16	68.07	85.06	40.13	0.96
	July	91.01	70.02	93.22	53.28	4.18
	Aug.	87.08	67.03	94.30	61.00	5.78
	Sept.	82.01	60.20	90.20	50.26	5.18
	Oct.	71.23	44.11	93.17	42.01	1.16
	Nov.	63.12	43.20	98.08	54.14	3.23
	Dec.	49.26	33.17	95.00	62.29	8.56
1965.....	Jan.	52.03	34.29	95.15	58.04	3.18
	Feb.	51.27	32.18	97.03	53.12	5.56

Table 40.--History of pesticide application and residue levels in soils

[ND = no residues detected]

AREA FBA: 512 acres cropland; 120 acres uncultivated

Pesticide	Years applied	Average application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residues per positive sample
Toxaphene[2]:		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
Cropland (269 A. treated)..	1956-57	2.0	3.00	8.94	--	--	--	[3] 0.40
Uncultivated.....	--	--	--	--	--	--	--	[4] 0.55
Arsenic:								
Cropland (512 A. treated)..	--	--	--	--	71	6.28	100	6.28
Uncultivated.....	--	--	--	--	20	2.94	100	2.94
BHC/lindane[5].....	--	--	--	--	162	<0.01	1.85	0.11
Dieldrin.....	--	--	--	--	162	ND	0	--
DDT.....	--	--	--	--	162	0.07	20.98	0.33
Carbaryl:								
Cropland (216 A. treated)..	1959	1.0	2.00	2.00	--	--	--	--
Uncultivated.....	--	--	--	--	--	--	--	--
DEF:								
Cropland (136 A. treated)..	1962, 1964	1.0	1.50	3.00	--	--	--	--
Uncultivated.....	--	--	--	--	--	--	--	--
Diuron:								
Cropland (128 A. treated)..	1961-62	1.0	1.40	2.80	--	--	--	--
Uncultivated.....	--	--	--	--	--	--	--	--
Malathion:								
Cropland (80 A. treated)...	1961	1.0	3.00	3.00	--	--	--	--
Uncultivated.....	--	--	--	--	--	--	--	--
Merphos:								
Cropland (216 A. treated)..	1959-61, 1964	1.0	2.25	3.39	--	--	--	--
Uncultivated.....	--	--	--	--	--	--	--	--

[1] See "Explanation of Tables", item 1, p. 5. [2] See "Explanation of Tables, item 3, p. 5. [3] 12 samples.
[4] 4 samples. [5] See "Explanation of Tables", item 4, p. 5.

Table 41.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC = no samples collected]

AREA FBA

Pesticide	May, June 1964			July 1964			August 1964			September 1964			December 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	ND	ND	NSC	NSC	ND	NSC	ND	ND	NSC	ND	ND	ND	NSC	ND	NSC
BHC/lindane[1].....	ND	ND	NSC	NSC	0.04	NSC	ND	ND	NSC	ND	ND	ND	NSC	ND	NSC
Dieldrin.....	0.19	ND	NSC	NSC	ND	NSC	ND	ND	NSC	ND	ND	ND	NSC	ND	NSC
DDT.....	ND	ND	NSC	NSC	ND	NSC	ND	ND	NSC	ND	ND	ND	NSC	ND	NSC
Endrin.....	ND	ND	NSC	NSC	ND	NSC	ND	ND	NSC	ND	ND	ND	NSC	ND	NSC
Heptachlor and/or heptachlor epoxide	0.08	ND	NSC	NSC	ND	NSC	ND	ND	NSC	ND	ND	ND	NSC	ND	NSC

Pesticide	January 1965			February 1965			Avg. May 1964 to Feb. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin.....	NSC	ND	NSC	NSC	ND	NSC	--	--	--
BHC/lindane[1].....	NSC	ND	NSC	NSC	ND	NSC	--	<0.01	--
Dieldrin.....	NSC	ND	NSC	NSC	ND	NSC	0.05	--	--
DDT.....	NSC	ND	NSC	NSC	ND	NSC	--	--	--
Endrin.....	NSC	ND	NSC	NSC	ND	NSC	--	--	--
Heptachlor and/or heptachlor epoxide	NSC	ND	NSC	NSC	ND	NSC	0.02	--	--

[1] See "Explanation of Tables", item 4, p. 5.

Table 42.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

[ND = no residues detected]

AREA FBA

Pesticide	May, June 1964	July 1964	August 1964	September 1964	December 1964	January 1965	February 1965	Average[1] May to Feb.
Samples collected (number)..	1	2	12	6	8	6	4	[2] 39
Aldrin.....	ND	ND	ND	ND	ND	ND	ND	--
BHC/lindane[3].....	ND	ND	ND	ND	0.03	ND	ND	<0.01
Dieldrin.....	ND	ND	ND	ND	ND	ND	ND	--
DDT.....	ND	ND	ND	ND	0.02	0.09	0.84	0.11
Endrin.....	ND	ND	ND	ND	0.05	ND	ND	0.01
Heptachlor.....	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor epoxide.....	ND	ND	ND	ND	ND	ND	ND	--
Strobane/toxaphene[4].....	--	--	--	--	--	[5] 2.00	--	--
Sulfur[4].....	--	--	--	--	--	--	[6] 2.70	--

[1] Average pesticides, May 1964 to Feb. 1965.
[2] Total samples collected, May 1964 to Feb. 1965.
[3] See "Explanation of Tables", item 4, p. 5.
[4] See "Explanation of Tables", item 3, p. 5.
[5] 1 sample.
[6] 3 samples.

Table 43.--Weather data for study area FBB

Year	Month	Average temperature		Average humidity		Total rainfall
		Maximum	Minimum	Maximum	Minimum	
		°F.	°F.	Pct.	Pct.	In.
1964.....	May	82.12	61.24	91.03	51.23	3.12
	June	90.16	68.08	85.10	44.07	0.79
	July	91.01	69.30	93.22	53.28	4.18
	Aug.	87.08	66.24	94.30	59.02	3.33
	Sept.	82.01	60.02	93.10	50.26	4.99
	Oct.	71.23	44.11	93.17	42.01	.86
	Nov.	62.26	42.29	98.09	55.20	3.72
	Dec.	49.02	33.11	91.06	63.16	8.52
1965.....	Jan.	49.17	32.11	92.07	54.02	3.34
	Feb.	51.05	29.26	94.14	51.11	4.98

Table 44.--History of pesticide application and residue levels in soil

[ND = no residues detected]

AREA FBB: 646 acres cropland

Pesticide	Years applied	Average application per year	Average rate per application (actual)	Cumulative amount applied[1]	Total samples analyzed	Average amount residue per sample	Samples positive	Average amount residues per positive sample
		Number	Lb./A.	Lb./A.	Number	P.p.m.	Pct.	P.p.m.
Arsenic		--	--	--	70	6.22	100	6.22
Dieldrin		--	--	--	122	<0.01	1.63	0.11
DDT		--	--	--	122	0.09	17.21	0.53
Heptachlor		--	--	--	122	ND	--	--
BHC/lindane[2]		--	--	--	122	0.01	0.81	0.08
Strobane/toxaphene[3]		--	--	--	--	--	--	[4] 0.23
Dalapon (10 A. treated)	1962	1.0	3.00	--	--	--	--	--
Carbaryl (216 A. treated)	1964	1.0	2.00	--	--	--	--	--

[1] See "Explanation of Tables", item 1, p. 5.
[2] See "Explanation of Tables", item 4, p. 5.
[3] See "Explanation of Tables", item 3, p. 5.
[4] 17 samples.

Table 45.--Comparison of pesticide residue levels in water, monthly collections, average parts per billion

[ND = no residues detected; NSC = no samples collected]

AREA FBB

Pesticide	May, June 1964			July 1964			August 1964			September 1964			December 1964		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin	0.08	ND	NSC	ND	ND	ND	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
BHC/lindane[1]	ND	ND	NSC	<0.01	ND	ND	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Dieldrin	0.04	ND	NSC	ND	ND	ND	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
DDT	0.12	ND	NSC	<0.01	ND	ND	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Endrin	ND	ND	NSC	ND	ND	ND	ND	ND	NSC	ND	ND	NSC	NSC	ND	NSC
Heptachlor and/or heptachlor epoxide	ND	ND	NSC	ND	ND	ND	ND	ND	NSC	ND	ND	NSC	NSC	0.10	NSC

Pesticide	January 1965			February 1965			Avg. May 1964 to Feb. 1965		
	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff	Wells	Surface water sources	Quick runoff
Aldrin	ND	ND	NSC	NSC	ND	NSC	<0.01	--	--
BHC/lindane[1]	ND	ND	NSC	NSC	ND	NSC	<0.01	--	--
Dieldrin	ND	ND	NSC	NSC	ND	NSC	<0.01	--	--
DDT	ND	ND	NSC	NSC	ND	NSC	0.02	--	--
Endrin	ND	ND	NSC	NSC	ND	NSC	--	--	--
Heptachlor and/or heptachlor epoxide	ND	ND	NSC	NSC	ND	NSC	--	0.01	--

[1] See "Explanation of Tables", item 4, p. 5.

Table 46.--Comparison of pesticide residue levels in sediment collected monthly in surface water sources, average parts per million

AREA FBB [ND = no residues detected]

Pesticide	May, June 1964	July 1964	August 1964	September 1964	December 1964	January 1965	February 1965	Average May to Feb.[1]
Samples collected (number)..	1	8	7	10	8	7	4	[2] 45
Aldrin.....	ND	ND	ND	ND	ND	ND	ND	--
Dieldrin.....	ND	ND	ND	ND	ND	ND	ND	--
DDT.....	ND	ND	ND	0.02	ND	<0.01	0.08	0.01
Endrin.....	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor.....	ND	ND	ND	ND	ND	ND	ND	--
Heptachlor epoxide.....	ND	ND	ND	ND	ND	ND	ND	--
BHC/lindane[3].....	ND	ND	ND	ND	0.02	ND	ND	<0.01
Sulfur[4].....	--	--	--	--	--	--	[5] 2.75	--

[1] Average pesticides, May 1964 to Feb. 1965.
[2] Total samples collected, May 1964 to Feb. 1965.
[3] See "Explanation of Tables", item 4, p. 5.
[4] See "Explanation of Tables", item 3, p. 5.
[5] 2 samples.

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USE PESTICIDES SAFELY

Pesticides used improperly may cause injury to man and animals. Use them only when needed and handle them with care. Follow the directions and heed all precautions on the labels.